Medicaid Program Evaluation

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January 1987
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An Evaluation of Utah's Primary Care Case Management Program for Medicaid Recipients

Stephen H. Long
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The Maxwell School
Syracuse University

Department of Health and Human Services
Health Care Financing Administration
Office of Research and Demonstrations

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EXECUTIVE SUMMARY

The Omnibus Budget Reconciliation Act (OBRA) of 1981 altered federal requirements concerning Medicaid in a number of ways. One important change--stemming from Section 2175 of OBRA--gave states new flexibility to institute programs for limiting Medicaid enrollees' freedom of choice of provider. An important federal objective underlying this legislative change was to encourage the states to seek alternative, lower cost ways of providing the Medicaid population with medically necessary care. Several states developed case management (CM) programs following OBRA's passage. This study evaluates the accomplishments of one of these programs, specifically, the one developed by the State of Utah.

Utah had two basic reasons for wanting to limit recipients' freedom of choice. First, the state expected to save money by controlling recipients' access to health care services. State officials believed that complete freedom of choice permitted behavior that inflated the cost of the Medicaid program. It was felt that many recipients relied upon multiple health care providers, resulting in duplicative and excessive use of medical resources. Moreover, there was concern that many recipients turned too readily to expensive emergency rooms for nonemergency care, rather than seeking care from the less expensive alternative, namely, a primary care physician.

Second, the state argued that its program for controlling recipients' access to health care services would actually enhance access and improve the quality of care for many Medicaid

enrollees. Access improvements were anticipated for two reasons. First, by assigning enrollees to specific physicians or an HMO, each enrollee would know immediately whom to contact when the need for medical care arose. Under the earlier (pre-OBRA) freedom-of-choice arrangements, enrollees were responsible for finding their own health care providers; of course, such providers had to be willing to accept Medicaid patients. Since only about 20 to 25 percent of all physicians in Utah accepted Medicaid patients, this undoubtedly represented an access problem for some enrollees, which could be avoided under the proposed "gatekeeper" program, where they would be assigned to a participating physician. Second, state officials hoped that the new program would encourage more physicians to participate in Medicaid, thereby further enhancing enrollees' access to medical care. Improvements in the quality of care received by Medicaid clients were anticipated because Utah's case management program replaced a system that permitted episodic, uncoordinated care from a variety of providers with one that assures continuity of care through a primary care case manager.

The goals and design of the case management program imply the following hypotheses--all of which are tested in this study--concerning the impact of CM on recipient utilization patterns:

- Increased recipient use of primary care providers;
- Reduced nonemergency use of ERs and OPDs;
- Reduced use of specialists; and

- Reduced use of prescription drugs.

These hypotheses arise not only from the goals and design of the CM program, but also from preliminary evidence generated by an early state assessment of the impact of case management.

To acheive both the cost containment and access objectives, the savings from reductions in unnecessary use must more than offset increases in outlays arising from access enhancements. Framed in terms of a testable hypothesis:

- case management lowers overall program costs.

The empirical investigation relies upon a two-part model of utilization behavior, that focuses first on the factors affecting whether a Medicaid enrollee uses any amount of a medical service, and then on the factors influencing the level of use among those actually using a service. Separate probability and level-of-use equations are estimated for several Medicaid-covered ambulatory services, all measured at the level of the individual Medicaid client. Specifically, these include:

- Primary care physician services;
- Specialist services;
- ER/OPD services;
- Clinic services;
- Hospital-based physician services; and
- Prescription drugs.

These equations were estimated with data provided by the State of Utah.

Do the findings support acceptance or rejection of the hypotheses concerning the impact of case management? The answer is mixed: some receive support from the findings, while others do not.

Primary care physician services. Case management was expected to increase recipient use of primary care providers. The evidence suggests that this objective was achieved. Case management raises the likelihood of contact during a month by 33 percent, a highly significant impact. However, it does not seem to alter the level of use among users: paid claims per month (adjusted for other factors) are essentially the same for both groups.

Specialists' services. An important goal of Utah's case management program is reducing the use of specialists' services. The estimates imply that the program has fallen short with respect to this objective. The predicted likelihood of seeing a specialist is actually greater among the case managed group, although the difference does not attain statistical significance. Moreover, no difference in the level of use among users in the treatment and control groups was detected. While the evidence does not support the inference that case management raises the use of specialists' services, it clearly supports rejection of the notion that case management lowers the use of specialists.

Hospital ER/OPD services. In part, case management was designed to lower the nonemergency use of hospital ERs and

OPDs. The evidence indicates that, on balance, case management attained modest savings in the use of ER/OPD services. Compared to the control group, expected dollar claims for case managed enrollees were 11.5 percent lower. Notably, this aggregate savings was achieved through a combination of 1) heightened likelihood of using ER/OPD services during a month (25 percent greater among the case managed), but 2) reduced level of use among the users of these services (29 percent less among the case managed).

Prescription drugs. Reducing the use of prescription drugs was another objective of the case management program. The findings indicate clearly that this objective was not achieved. To the contrary, prescription drug use appears to have risen by statistically significant amounts under case management. Compared to the controls, case managed enrollees are 42 percent more likely to use prescription drug services during a month. Further, among those obtaining prescription drugs, the level of use (as measured by paid claims) simply seems unaffected by case management. The combined effect results in a substantial increase (of about 42 percent) in expected dollar claims per case managed enrollee.

Cost containment. Lowering overall costs for the Medicaid program was the principal federal motive for the case management idea. Indeed, early estimates by the State of Utah suggested substantial savings from case management. However, the evidence does not confirm the notion that case management ultimately saves

money. In connection with five of the six services investigated, case management seems to raise the cost of providing care for Medicaid recipients. A weighted average of the predicted effects for all of the services provides an image of the overall cost implications of case management. Across all six services, case management raises expected dollar claims per Medicaid enrollee by 25 percent, after adjusting for other factors.

Over the long run, or under different administrative arrangements and with different incentives to providers, this particular estimate of added cost from case management might vary. For example, some of the higher use observed might be transitory--both as a result of the newly case-managed population "trying out" their new primary care physicians and as a result of treating the pent-up health needs of a relatively underserved population. On the other hand, the effectiveness of the gatekeeper in holding down doctor-shopping and self-referrals might be reduced over the longer run as recipients learn ways to beat the system. Only with strong economic incentives for primary care providers to reduce enrollees' total use does it seem likely that Utah's CM program can achieve its cost containment objective simultaneously with increased access.

The Omnibus Budget Reconciliation Act (OBRA) of 1981 altered federal requirements concerning Medicaid in a number of ways. One important change--stemming from Section 2175 of OBRA--gave states new flexibility to institute programs for limiting Medicaid enrollees' freedom of choice of provider. Subject to approval of the Secretary of Health and Human Services, a state was permitted under OBRA to implement a case management (CM) program which restricts individual enrollees to a single provider for all nonemergency primary care. Approval from the Secretary hinges on the state satisfying two key requirements: 1) the CM restrictions must not "substantially impair access" to primary care services of "adequate quality where medically necessary;" and 2) they must be "cost effective." Clearly, the federal objective underlying this legislative change was to encourage the states to seek alternative, lower cost ways of providing the Medicaid population with medically necessary care.

Several states developed CM programs following OBRA's passage (see, e.g., Fruend, 1984). This study evaluates the accomplishments of one of these programs, specifically, the one developed by the State of Utah.1

The findings of this investigation are described in this report, which is organized in the following way. The next section provides background information necessary for understanding the key features of Utah's case management program. Section II lays out the research hypotheses, which stem basically from the stated goals of the program. The research methodology is presented in

Section III. The results of the empirical analyses are reported in Section IV. The final section contains a discussion of the findings.

I. BACKGROUND

In response to the new flexibility provided by OBRA, the State of Utah applied for a waiver of the "freedom of choice" requirements governing its Medicaid program in November 1981. Essentially, Utah wanted permission to assign each Medicaid enrollee either 1) to a specific primary care physician--a "gatekeeper" or "case manager"--who would have complete responsibility for providing, or arranging for, the enrollee's primary, nonemergency health care; or 2) to a health maintenance organization (HMO), which would have the same type of responsibilities as the physician gatekeepers.[2] This request was approved in March 1982, and implementation of Utah's Choice of Health Care Delivery (CHCD) program began in August 1982.

In its first couple of months, the program was limited to Salt Lake County, which encompasses Salt Lake City and thus contains about 40 percent of Utah's population (which equalled 1.5 million in 1980). In October 1982, the CHCD program was extended northward to the neighboring counties of Davis and Weber, which jointly contain about 20 percent of the state's population. In January 1983, it was extended southward into neighboring Utah County, covering another 15 percent of the state's population.[3] The remaining 25 percent of the state's population is scattered across 25 largely rural

counties. Due to administrative problems and limited availability of Medicaid providers in these rural areas, the CHCD program was not extended into them, at least not during the time period pertinent to this study.

There were two basic reasons for wanting to limit recipients' freedom of choice.[4] First, the state expected to save money by controlling recipients' access to health care services. State officials believed that complete freedom of choice permitted behavior that inflated the cost of the Medicaid program. It was felt that many recipients relied upon multiple health care providers, resulting in duplicative and excessive use of medical resources. Moreover, there was concern that many recipients turned too readily to expensive emergency rooms for nonemergency care, rather than seeking care from the less expensive alternative, namely, a primary care physician.

Second, the state argued that its program for controlling recipients' access to health care services would actually enhance access and improve the quality of care for many Medicaid enrollees. Access improvements were anticipated for two reasons. First, by assigning enrollees to specific physicians or an HMO, each enrollee would know immediately whom to contact when the need for medical care arose. Under the earlier (pre-OBRA) freedom-of-choice arrangements, enrollees were responsible for finding their own health care providers; of course, such providers had to be willing to accept Medicaid patients. Since only about 20 to 25 percent of all physicians in Utah accepted

Medicaid patients, this undoubtedly represented an access problem for some enrollees, which could be avoided under the proposed "gatekeeper" program, where they would be assigned to a physician. Second, state officials hoped that the new program would encourage more physicians to participate in Medicaid, thereby further enhancing enrollees' access to medical care. Improvements in the quality of care received by Medicaid clients were anticipated because the CHCD program replaced a system that permitted episodic, uncoordinated care from a variety of providers with one that assures continuity of care through a primary care case manager.

In translating these general goals into specific testable hypotheses, it is essential to understand some of the details of the CHCD program; the remainder of this section is devoted to this task. In the end, data limitations restrict the empirical analysis to those enrollees selecting a case manager rather than an HMO. Accordingly, the following discussion of the salient features of the CHCD program concentrates on the case management (CM) portion. Further, it is organized around the two general goals of cost containment and enhanced access.

Cost Containment

Achievement of the cost containment objective hinges on controlling recipients' use of nonemergency medical services by requiring them to go through a gatekeeper, that is, their case manager. Essentially, two things need to happen. First, Medicaid

enrollees must find access to nonemergency care from anyone other than their gatekeeper (or someone authorized by their gatekeeper) diminished greatly, if not entirely eliminated. Second, the gatekeepers actually have to restrict their Medicaid clients' use of unnecessary medical services. In what ways is the CHCD program designed to assure that these things happened?

Enrollee participation in the CHCD program was assured by making it mandatory. As part of the eligibility determination process,[5] enrollees are required to either join an HMO or select a case manager. Since the choice is made as part of a personal interview with a Medicaid representative, it is difficult to avoid, although not entirely impossible, at least for a limited period of time[6]. When an enrollee chooses the HMO option, the representative forwards the enrollee's name to the participating HMO, which then contacts the recipient directly (Bell, 1986). Those selecting case management must choose a specific physician, whose willingness to serve as case manager is then confirmed by telephone. If that physician declines, the process is repeated until a willing case manager is found.

Tying enrollment in the CHCD program to the eligibility determination (and re-determination) process assured that the program would be phased-in gradually. Indeed, by December 1983, when the program was more than a year old, only about 50 percent of all eligible Medicaid clients had enrolled in the CHCD program.[7]

Once a case manager is identified, his or her name is printed on the enrollee's Medicaid card, and is supposed to appear on each subsequent card received by the enrollee.[8] Placing the case manager's name on the Medicaid card serves two purposes: 1) it reminds enrollees who to contact for medical care; but more importantly, 2) it also announces to other providers that giving a Medicaid client care not authorized by the indicated gatekeeper may result in an unpaid claim.[9] Probably as much as anything else, this aspect of the CHCD program helps direct Medicaid enrollees to their gatekeeper for nonemergency medical care.

Enrollees can switch case managers, although not easily: changes made within a year of the initial assignment to a case manager must be justified during a personal interview with a Medicaid representative. Presumably, this provision makes it difficult for enrollees to shop around for case managers who are ineffective at controlling recipients' unnecessary use of medical services.

This last point naturally raises the issue of whether case managers will actually control recipients' use of medical services. Program rules stipulate that case managers are responsible for either providing or authorizing all nonemergency care for their Medicaid patients. Yet, the program contains few, if any, incentives for encouraging physicians to act as conscientious case managers for their Medicaid patients. Case managers are paid standard Medicaid rates for medical services

rendered. They are not paid a separate case management fee; and they are not financially "at risk" for their Medicaid clients' medical expenses. Further, while referrals to specialists require case managers to initiate a referral form (with a copy going to Medicaid officials), this requirement imposes no real barrier to unnecessary referrals; in fact, case managers can refer Medicaid patients to specialists without even making a clinical assessment (Fruend, p. 35). Thus, case managers are neither rewarded directly for effective performance as a gatekeeper, nor penalized for ineffective performance.[10] In short, the design of the CHCD program provides case managers with no obvious reason, other than perhaps a moral obligation, to help the Medicaid program save money.

Enhanced Access

The CHCD program contains several features which, in principle, could enhance enrollees' access to health care services. First, the enrollment procedures should facilitate some access improvements. In selecting a case manager, Medicaid clients are assisted by a program representative, who both helps in making the selection and then telephones to confirm the physician's willingness to serve as case manager. Moreover, the physician's agreement is confirmed by mail, and his or her name is printed on the enrollee's Medicaid card. All of these steps assure that every CHCD participant has a case manager who has agreed to provide enrollees with 24-hour access to primary, nonemergency health care services.[11] Presumably, this represents

an improvement in access for at least some, if not many, Medicaid beneficiaries.

Second, in order to encourage physician participation in the CHCD program, no restrictions were imposed on physicians' freedom to reject Medicaid patients. Serving as a case manager for one Medicaid client would not obligate a physician to become a case manager for others. Moreover, a physician can disenroll a Medicaid patient from the practice's caseload at any time, so agreeing to become a case manager does not lock a physician into a long-term obligation. While this freedom may work to the disadvantage of some Medicaid enrollees, it probably serves, on balance, to enhance recipient access by lowering the cost of participation to physicians, thereby encouraging their involvement in the program.

Physician participation was further encouraged by the fact that all Utah physicians, including specialists, are potentially eligible to serve as primary care case managers. The only essential requirement for participation is that physicians must agree to abide by the rules of the CHCD program (e.g., provide 24-hour access to "necessary" medical services).

In contrast to the foregoing features of the CHCD program, its reimbursement aspects probably serve both to encourage physician participation and discourage it. The program's fee-for-service arrangement for paying physicians is presumably attractive to them, even though the levels of the fees may be seen as too low. Another reimbursement feature physicians

presumably find appealing is the Medicaid program's acceptance of the financial risk for the Medicaid clients: in other words, the case managers are not financially responsible for the medical expenses of their Medicaid patients. The financial disincentive in the reimbursement arrangements arises from the failure of the CHCD program to pay case managers a separate fee for their case management services. Asking physicians to accept more responsibility for their Medicaid patients without offering some corresponding financial reward undoubtedly strikes some physicians as unreasonable, leaving them unwilling to participate in the CHCD program.

II. HYPOTHESES

The stated objectives of the CHCD program and the specific details of its design imply a number of testable research hypotheses. This study investigates empirically several of these hypotheses, but others are not pursued because of data limitations. The following discussion concentrates on those hypotheses actually investigated here, but also notes those left unexamined.

One of the principal objectives of the CHCD program is to better manage recipients' use of medical services. In practice, this objective translates essentially into one of changing the mix of services received by Medicaid patients. Specifically, the goals and design of the case management program imply the following hypotheses--all of which are tested in this

study--concerning the impact of CM on recipient utilization patterns:

- Increased recipient use of primary care providers;
- Reduced nonemergency use of ERs and OPDs;
- Reduced use of specialists;
- Reduced use of prescription drugs.

These hypotheses arise not only from the goals and design of the CM program, but also from preliminary evidence generated by an early state assessment of the impact of case management. Based upon these preliminary findings, the State of Utah feels that, in the first year of the program, the CM program 1) lowered dollar claims for ER services for case-managed Medicaid clients by 36 percent; and 2) reduced the number of pharmacy claims per client by 12 percent.12

In addition to the foregoing impacts, CM should reduce the extent of doctor shopping (e.g., resulting in a lowering of the average number of physicians seen by recipients) and other forms of duplicative use of medical services,13 while at the same time improving the quality of care by assuring continuity of care through primary care providers. However, these particular effects--or hypotheses--cannot be assessed with the data employed in this study, and, thus, are not considered further.

Another important objective of the CHCD program is cost containment. While the program was supposed to improve access to primary health care services, it was also designed to reduce unnecessary utilization. The savings from reductions in

unnecessary use were expected to more than offset increases in outlays arising from access enhancements. Framed in terms of a testable hypothesis:

- case management lowers overall program costs.

Preliminary findings by the state of Utah provide seemingly strong support for this hypothesis. The assessment of early evidence by the state resulted in a first-year savings estimate of $1.3 million, which translates into $4.30 saved for every $1 invested in the program.14

III. METHODS

Research Design

A valid test of the foregoing hypotheses requires a research design capable of isolating the effect of case management on Medicaid program expenditure patterns and levels. The design adopted for this study is a standard one, relying upon cross-sectional comparisons between a "treatment group" of case-managed enrollees and a "control group" of Medicaid clients eligible for case management but not yet enrolled into the CM program.15 It was possible to establish the treatment and control groups in this way because CM was phased-in slowly, leaving thousands of Medicaid clients eligible for CM, but unenrolled for many months.

Under ideal circumstances, treatment and control groups are established through random assignment of individuals to the two groups, thereby minimizing, if not eliminating, inter-group

differences capable of confounding the estimated effect of the treatment (in this instance, case management). Since Medicaid clients were obviously not assigned randomly to case management, it is necessary to rely upon multivariate statistical methods to control for potentially confounding differences between the treatment and control groups.

However, even with statistical controls for observable differences in demographic characteristics (e.g., age or sex), the possibility remains that unobserved differences between the groups, arising from the way people get assigned to one group or the other, will still result in biased estimates of the effect of case management. (This problem is usually labelled "selection bias.") To illustrate the nature of the problem more fully, consider the implications of an enrollment process that allows Medicaid clients with sufficient determination to evade case management for extended periods. In all likelihood, the motivation to avoid case management is greater among high users of Medicaid services than among low users. Thus, during the early stages of implementation, the case-managed population could easily exhibit lower utilization rates than the control group, even if case management itself were completely ineffective at controlling use, simply because the enrollment process creates underlying inter-group differences in the propensity to use medical services. Clearly, the research design must address this problem of selection bias in order to isolate the effect of case management on utilization and expenditure patterns.

This study handles the selection-bias problem by controlling statistically for individual differences in "prior use," that is, observed utilization for a time period immediately preceding that employed for the utilization comparisons between the treatment and control groups.[16] The presumption is that differences in prior use rates will tend to reflect underlying variation in the propensity to use medical services. Thus, controlling for differences in prior use helps control for this unobservable propensity to use health services, thereby enhancing the accuracy of the estimates of case management's impact on Medicaid expenditure patterns.

Empirical Model

The empirical investigation relies upon a two-part model of utilization behavior (see, e.g., Manning). This model focuses first on 1) the factors affecting whether a Medicaid enrollee uses any amount of a medical service, and then on 2) the factors influencing the level of use among those actually using a service.

Separate probability and level-of-use equations are estimated for several Medicaid-covered ambulatory services, all measured at the level of the individual Medicaid client. Specifically, these include:

- Primary care physician services;
- Specialist services;
- ER/OPD services;
- Clinic services;

- Hospital-based physician services;
- Prescription drugs.

The estimating equations make these dependent variables a function of several independent variables. The key independent variable reflects:

- whether or not a Medicaid enrollee is case managed.

The remaining independent variables control for factors other than case management that could cause inter-group variation in utilization rates and cloud the assessment of case management' effect. These other variables control for the individual client's:

- age;
- sex;
- race;
- county of residence; and,
- prior use of Medicaid services.17

Data

The research design employed in this study establishes certain minimal requirements for the analytic data file. Essentially, the design requires 1) person-level information, since the individual Medicaid client serves as the unit of analysis; 2) observations on Medicaid clients who were case managed for the entire period covered by the analysis (i.e., the treatment group); 3) data on others who were enrolled in Medicaid for the entire analysis period, but not case managed

(i.e., the control group); 4) measures of utilization among the treatment and control group members both during and prior to the time period selected for the analysis; and 5) information necessary for developing the other control variables in the multivariate model.

Under ideal circumstances, these requirements could be satisfied by drawing upon two different, but related, databases: 1) a Medicaid enrollment file and 2) Medicaid claims files. The former permits accurate identification of all Medicaid enrollees, the period of time spanned by their eligibility, and whether they were case managed, among other things. The latter provides information on the use of Medicaid-covered services, along with other information also available from the enrollment file (e.g., age, sex, race, case management status).

While the State of Utah provided the Medicaid claims files for all of 1983 and the first half of 1984, it did not, unfortunately, grant access to the Medicaid enrollment file. Consequently, it was necessary to base the entire evaluation on information extracted from the claims files alone[18].

In light of this constraint on data, aggregating the claims-level data into person-level observations was the only way to satisfy the research design's requirement concerning the unit of analysis.[19] While this approach to creating a person-level data file is costly and time-consuming, it is nevertheless feasible. However, it also limits the analysis to Medicaid

recipients (as opposed to all Medicaid enrollees), since claims are submitted, by definition, for recipients of services only.

Identification of appropriate observations for inclusion in the treatment and control groups is also complicated by the lack of an enrollment file. One problem stems from the fact that claims files offer only partial glimpses of a person's eligibility for Medicaid services. Eligibility for Medicaid can vary from month to month. Thus, while the presence of a paid claim in one month confirms a person's eligibility for that particular month, it does not confirm eligibility for any preceding or any subsequent month. With claims data, confirmation of continuous eligibility over a period of time requires a set of claims that in some way span that time period.

This problem was resolved in the following way. First, the analytic time period was limited to one month: December 1983.[20] This step simplifies greatly the task of establishing a person's eligibility. Rather than confirming continuous eligibility over a several month period, it is necessary only to establish it for one. While this approach obviously limits variation in the key utilization measures, it offers an important advantage in connection with sample size. Expanding the time frame for the analysis beyond one month diminishes substantially the number of observations on persons with confirmed continuous eligibility.

The second step concerns the procedure for actually establishing a person's eligibility for December. Rather than

limiting the observations to those with paid claims for December, the sample was expanded to include those using Medicaid services at some time in both the preceding three months and the following three months. The logic behind this decision is that utilization in a relatively narrow time period on both sides of December makes it highly probable that eligibility spanned that key month. This approach to defining eligibility offers an important advantage: it permits the sample to contain observations on both users and nonusers of services for the analysis month, thereby both expanding the sample size and increasing the variation in the dependent variables.

Observations for the treatment and control group samples were identified by inspecting the case management flag included in the claims records. The objective was to limit the samples to those who were clearly in one group or the other for the entire month of December. Accordingly, observations for the treatment group were limited to persons with claims records indicating case management both before and after December. Further, for those using services in December, the claims for that month also had to indicate case management for the observation to be included in the treatment group sample. Similar criteria were employed in identifying observations for the control group: only those with claims records indicating no case management both before and after (and, where appropriate, during) December were selected.

Creating a prior use measure from claims-level data required one further sample selection criterion. A prior use variable

reflects utilization--in this instance, total paid claims--for some earlier, well-defined time period. For this study, the time period selected for measuring prior use is six months.21 Of course, measuring prior use with claims data again raises the problem of confirming a person's eligibility for the time period in question, June through November in this instance. To provide some assurance of continuous eligibility over the prior use period, it was necessary to restrict the sample to observations on persons with paid claims for services received during a 5 month time frame before the June-November prior use time period.

The foregoing sample-selection criteria that concentrate on establishing a person's continuous eligibility for Medicaid are summarized in Table 1. While these criteria fail to guarantee fully that only those Medicaid enrollees with continuous eligibility over the relevant time period remain in the analysis sample, they offer reasonable assurance that the preponderance of observations satisfy this requirement. Of equal importance, they yield an analysis sample sufficiently large (n = 7899) to permit tests of the various case-management hypotheses, even though the dependent variables pertain to a very short time period and thus exhibit relatively limited variation.

Table 2 provides definitions for the dependent and independent variables developed from this analysis sample, while Table 3 contains the corresponding descriptive statistics. For the most part, the means and proportions reported in Table 3 refer to the entire analysis sample of 7899 observations. The

Table 1

Utilization Requirements Imposed by Sample-Selection Criteria Designed to Assure Continuous Eligibility for Medicaid Services

	Utilization Behavior during the Analysis Month:	
Time Period	User	Nonuser
	Are paid claims required?	
December 1983 (the analysis month)	Yes	No[1]
September-November 1983 and January-March 1984	Not required, but may occur.	Yes
June-November 1983 (the prior use time period)	Not required, but may occur.	Yes[2]
Five months preceding June 1983	Yes	Yes

[1] By definition, persons in this category have no paid claims in December.

[2] There must be some prior use, since this group was selected on the basis of having paid claims during September-November 1983, a period encompassed by the prior use time frame.

Table 2

Definitions of Dependent and Independent Variables Employed in the Multivariate Analyses

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Dependent Variables

Primary care physician services: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Specialists' services: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Hospital ER or OPD services: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Prescription drugs: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Clinic-based physician services: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Hospital-based physician services: equals 1 if Medicaid enrollee had at least one paid claim for such services for December 1983; otherwise 0.

Primary care physician expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Specialist expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Hospital ER or OPD expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Prescription drug expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Clinic-based physician expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Table 2 (continued)

Hospital-based physician expenditures: total dollar amount of paid claims for a Medicaid enrollee's use of this service during December 1983.

Independent Variables

Case managed: equals 1 if enrollee was case managed during December, otherwise 0.

Prior use: total dollar amount of paid claims for an enrollee for the six months preceding December.

Age/Sex Categories

Child, less than 1 year: equals 1 if enrollee's age falls into this category; otherwise 0.

Child, 1 to 4 years: equals 1 if enrollee's age falls into this category; otherwise 0.

Child, 5 to 11 years: equals 1 if enrollee's age falls into this category; otherwise 0.

Female, 12 to 17 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Female, 18 to 24 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Female, 25 to 44 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Female, 45 to 64 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Male, 12 to 17 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Male, 18 to 24 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Male, 25 to 44 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Male, 45 to 64 years: equals 1 if enrollee's sex and age fall into this category; otherwise 0.

Table 2 (continued)

Race/Ethnicity

Black: equals 1 if enrollee is black; otherwise 0.

Hispanic: equals 1 if enrollee is hispanic; otherwise 0.

White: equals 1 if enrollee is white; otherwise 0.

Other race: equals 1 if enrollee's race/ethnicity is other than the foregoing; otherwise 0.

County of Residence

Salt Lake: equals 1 if enrollee's residence is this county; otherwise 0.

Weber: equals 1 if enrollee's residence is this county; otherwise 0.

Utah: equals 1 if enrollee's residence is this county; otherwise 0.

Davis: equals 1 if enrollee's residence is this county; otherwise 0.

Table 3
Selected Descriptive Statistics for the Analysis Sample

Variable Name	All	Case Managed	Not Case Managed
	Mean or Proportion		
Dependent Variables:			
Proportion using the following Medicaid-covered services during December:			
Primary care physician	0.172	0.189	0.148
Specialist	0.086	0.093	0.076
Hospital emergency room or outpatient department	0.081	0.090	0.068
Prescription drugs	0.397	0.455	0.311
Clinic-based physician services	0.057	0.068	0.041
Hospital-based physician services	0.045	0.051	0.036
Average dollar claims for users of the following services:			
Primary care physician	$57.25	$54.76	$61.95
Specialist	$115.51	$106.02	$132.80
Hospital emergency room or outpatient department	$87.18	$77.49	$106.05
Prescription drugs	$17.91	$18.10	$17.50
Clinic-based physician services	$50.78	$54.89	$40.69
Hospital-based physician services	$37.74	$36.66	$40.02
Independent Variables:			
Proportion case managed	0.596	1.000	0.000
Prior use (average dollar claims for June-November 1983)	$497.59	$516.77	$469.31

Table 3 (continued)

Variable Name	All	Case Managed	Not Case Managed
	Mean or Proportion		
Age/Sex Categories:			
Child, less than 1 year	0.039	0.025	0.058
Child, 1 to 4 years	0.237	0.235	0.240
Child, 5 to 11 years	0.188	0.185	0.192
Female, 12 to 17 years	0.057	0.052	0.064
Female, 18 to 24 years	0.170	0.181	0.155
Female, 25 to 44 years	0.236	0.257	0.205
Female, 45 to 64 years	0.018	0.018	0.019
Male, 12 to 17 years	0.037	0.031	0.046
Male, 18 to 24 years	0.002	0.002	0.002
Male, 25 to 44 years	0.012	0.010	0.013
Male, 45 to 64 years	0.005	0.005	0.006
Race/Ethnicity:			
Black	0.031	0.032	0.029
Hispanic	0.122	0.120	0.124
White	0.823	0.829	0.813
Other	0.025	0.019	0.034
County of Residence:			
Salt Lake	0.503	0.498	0.511
Weber	0.206	0.238	0.159
Utah	0.204	0.207	0.199
Davis	0.088	0.058	0.131
Sample Size	7,899	4,707	3,192

Source: Authors' tabulations.

measures of dollar claims for selected Medicaid services represent an exception, however. They apply only to the relevant subsets of observations on users of the respective services.

Estimation Issues

This study investigates the causes of variation in two types of dependent variables. One type is dichotomous, indicating whether or not a person uses a particular health service, and applies to the entire analysis sample. The other type is continuous, indicating the amount paid for services received, and pertains to users of services only. The equations for explaining variation in the dichotomous dependent variables are estimated with the probit estimation procedure (Maddala, 1977). The other equations for explaining variation in continuous utilization measures are estimated with ordinary least squares.

Both the continuous expenditure variables and the prior use variable have non-normal, skewed distributions because of outlying observations. For example, while the average expenditure for primary care physician services in December 1983 was $57, the maximum expenditure was $1293, or roughly 10 standard deviations greater than the mean. To correct for this skewness, all expenditure variables were converted to logarithmic form. When measured in this way, the difference between mean and maximum values diminishes substantially. To illustrate, in logarithms the maximum expenditure for primary care physician services exceeds the mean expenditure by only 3 standard deviations.

IV. FINDINGS

The basic findings concerning the impact of case management are presented in Table 4. The entries in this table show the effect of case management on enrollee use of the principal types of ambulatory services, after adjusting for other determinants of utilization.22 The results are shown as percentages, indicating the predicted use by a case managed Medicaid enrollee relative to the predicted use by an enrollee not case managed. The first column of estimates apply to case management's impact on the probability of using a specific service during a month. (The numbers in parentheses are absolute valued _t_-statistics.) The second column indicates how the level of use among users (measured by the dollar total of paid claims for the month) are affected by case management. The interaction of these two foregoing effects is shown in the third column of estimates.23 The final column combines all of these effects into an estimate of case management's impact on expected utilization per enrollee.24

The evidence provided in Table 4 suggests that case management affects the probability of use differently than it affects the level of use among users. Relative to the control group of non-CM enrollees, case managed Medicaid enrollees are more likely to use services, with the difference being highly significant in every case but one (specialists' services). In contrast, the level of use among users typically differs insignificantly as between the case managed and the controls (the single exception is hospital ER/OPD services). In connection with

Table 4

Estimated Effects of Case Management on Enrollee Utilization, Adjusted for Other Determinants[1]

Type of Service	Impact of Case Management on:						
	Probability of Use Per Enrollee	+	Paid Claims Per User	+	Interaction	=	Expected Dollar Claims Per Enrollee
Primary care physician	32.6%* (5.03)		-2.4% (0.46)		-0.8%		30.4%
Specialist	12.9% (1.44)		-0.1% (0.01)		0		12.8%
Hospital ER or OPD	25.3%* (2.64)		-29.4%* (3.27)		-7.4%		-11.5%
Prescription Drugs	41.8%* (11.10)		0.4% (0.14)		0.2%		42.4%
Clinic-based physician	71.3%* (4.80)		12.6% (1.26)		9.0%		92.9%
Hospital-based physician	52.2%* (3.18)		-9.7% (1.10)		-5.0%		37.5%

Source: Authors' calculations, based upon multivariate estimates derived from Utah claims records for Medicaid recipients.

*Statistically significant at the 99 percent level of confidence for a two-tailed test.

[1] Absolute valued t-statistics are in parentheses.

the overall combined effect on utilization (the last column in Table 4), the findings indicate that case management raises utilization for five of the six services investigated, and lowers it for one (hospital ER/OPD).

Does this evidence support acceptance or rejection of the hypotheses concerning the impact of case management? The answer is mixed: some receive support from the findings, while others do not. The implications of the results for each hypothesis will be considered in turn.

Primary care physician services. Case management was expected to increase recipient use of primary care providers. The evidence suggests that this objective was achieved. Case management raises the likelihood of contact during a month by 33 percent, a highly significant impact. However, it does not seem to alter the level of use among users: paid claims per month (adjusted for other factors) are essentially the same for both groups.

Specialists' services. An important goal of Utah's case management program is reducing the use of specialists' services. The estimates in Table 4 imply that the program has fallen short with respect to this objective. The predicted likelihood of seeing a specialist is actually greater among the case managed group, although the difference does not attain statistical significance. Moreover, no difference in the level of use among users in the treatment and control groups was detected. While the evidence does not support the inference that case management raises the use of specialists' services, it clearly

supports rejection of the notion that case management lowers the use of specialists.

Hospital ER/OPD services. In part, case management was designed to lower the nonemergency use of hospital ERs and OPDs. The evidence indicates that, on balance, case management attained modest savings in the use of ER/OPD services.[25] Compared to the control group, expected dollar claims for case managed enrollees was 11.5 percent lower. Notably, this aggregate savings was achieved through a combination of 1) heightened likelihood of using ER/OPD services during a month (25 percent greater among the case managed), but 2) reduced level of use among the users of these services (29 percent less among the case managed).

Prescription drugs. Reducing the use of prescription drugs was another objective of the case management program. The findings in Table 4 indicate clearly that this objective was not achieved. To the contrary, prescription drug use appears to have risen by statistically significant amounts under case management. Compared to the controls, case managed enrollees are 42 percent more likely to use prescription drug services during a month. Further, among those obtaining prescription drugs, the level of use (as measured by paid claims) simply seems unaffected by case management. The combined effect results in a substantial increase (of about 42 percent) in expected dollar claims per case managed enrollee.

Cost containment. Lowering overall costs for the Medicaid program was probably the principal motivation behind the case management idea. Indeed, early estimates by the State of Utah

suggested substantial savings from case management. However, the evidence presented in Table 4 does not confirm the notion that case management ultimately saves money. In connection with five of the six services investigated, case management seems to raise the cost of providing care for Medicaid recipients. A weighted average[26] of the predicted effects for all of the services provides an image of the overall cost implications of case management. Across all six services, case management raises expected dollar claims per Medicaid enrollee by 25 percent, after adjusting for other factors.

V. DISCUSSION

A principal federal objective underlying the OBRA Medicaid changes was to offer the states greater flexibility to experiment with new programmatic approaches that had a potential for shared federal-state savings. Specifically, the 2175 freedom of choice waivers promised to be a cost-effective way to reduce the use of high cost services--for example, outpatient department and specialists' care--while assuring adequate access to office-based primary care services. Utah's case management program promised to seek these objectives. Moreover, it sought to achieve increased access to and continuity of primary care, since physician participation in Medicaid was viewed as too low. To meet the combined federal and state objectives, the cost of increased access to primary care physicians would have to be more than offset by the savings from reduced use of the OPD/ER, specialists' services, and prescription drugs.

What new program procedures or economic incentives were employed by Utah in seeking these objectives? Two changes might have increased primary care use and spending. Upon their initial eligibility or their redetermination hearing, the program helped Medicaid eligibles choose a case-manager known to accept Medicaid reimbursement. The association with this provider was reinforced by printing the physician's name on each subsequent Medicaid care. For primary care providers considering Medicaid participation, the case manager role seemingly offered a more continuous and, therefore, larger stream of revenue from each Medicaid patient seen. This might lead to increased participation, either through a greater number of participating physicians or through increased Medicaid patient loads among previous participants.

Corresponding procedures and incentives that might have reduced the use of high cost services were not employed by Utah during the period of this evaluation, however,. Although referral forms were used to signify that a case manager had given prior authorization for some specialized service, procedures had not been implemented to deny reimbursement for providers' bills that were unaccompanied by a referral form. Therefore, there was no economic incentive for specialists or OPDs to deny care to patients who self-referred. Moreover, Utah offered Medicaid case managers no direct financial incentives to alter their referral patterns. The only economic incentive for providers to change their behavior in a way that would lead to program savings was extremely indirect. The State proposed to share any aggregate

savings achieved by case management with those providers participating in the case management program. Due to the "free rider problem," this approach probably had little or no effect on individual providers' behavior: since each provider presumably recognizes that his or her Medicaid treatment and referral decisions will have a negligible effect on total program savings or costs, there is virtually no individual incentive to conserve on Medicaid resources. Obviously, if most providers respond in this fashion, as they almost surely will, few aggregate savings can be expected.

The quantitative findings of this evaluation support the above interpretation of the behavioral incentives created by the Utah case management program. Consistent with one of its key objectives, the program stimulated access to primary care physicians, with spending rising about 30 percent per enrollee. Some of the increased use may be the result of shifting patients to office-based physicians from more expensive sites--especially OPDs and ERs, where spending fell 12 percent. The increase also may have resulted from patients seeking additional primary care that would not otherwise have been provided. In the latter case it is reasonable to assume that increased access will lead to the detection of otherwise untreated conditions, resulting in additional referrals to specialists and additional drug prescriptions.

Complementarity between primary care services and other services would appear to make it very difficult to achieve simultaneously the cost savings objective and the access

objective. The findings presented here suggest that the Utah Medicaid program achieved its objective of enhanced access to primary care physicians. Moreover, the mix of services was shifted toward office-based care, away from OPD/ER care. However, this success in the access dimension was achieved at the expense of increased program costs. Across the six services investigated in this study, Utah's case management program was found to raise expected dollar claims by 25 percent per Medicaid enrollee, after adjusting for other factors. Rather than helping to contain Medicaid costs, Utah' case management program apparently inflates spending on balance.

Over the longer run, the actual added cost might differ from this estimate for several reasons. The present evaluation used data drawn from the program when roughly half the enrollee population was case-managed. Some of the higher utilization observed in the case-managed population could be transitory--both as a result of the newly case-managed population trying out their new primary care physicians, and as a result of treating pent-up health needs of a relatively under-served population. On the other hand, strong promotion of the "gatekeeper" role to recipients, who would otherwise "doctor-shop" and self-refer to specialists, might bring temporary restraint that over the longer run would give way to old habits--especially when it became clear that providers have no incentive to deny care to patients without a referral form. Regardless of the exact magnitude of increased cost under this particular case-management program, it seems likely that to achieve overall savings a program must provide for

strong economic incentives for primary care providers to reduce total spending on the enrolled population. Perhaps in a later stage of its development the Utah program will employ such methods in order to achieve federal objectives under it freedom of choice waiver.

REFERENCES

Bell, James, and Rosenthal, H.: "Utah's Case Management Primary Physician Program: Implementing Primary Care Case Management in Medicaid." Unpublished draft, February, 1986.

Fruend, Deborah A.: Medicaid Reform: Four Studies of Case Management. Washington, D.C. American Enterprise Institute, 1984.

Maddala, G. S.: Econometrics. New York. McGraw-Hill, 1977.

Manning, W., Morris, C., Newhouse, J., et al.: "A Two-Part Model of the Demand for Medical Care: Preliminary Results from the Health Insurance Study," in Jacques van der Gaag and M. Perlman, eds., Health, Economics, and Health Economics. Amsterdam. North-Holland, 1981.

Neuschler, E.: "Summary of Prepaid and/or Case Managed Care Project (Medicaid): Utah." Unpublished draft, December 1984.

ENDNOTES

[1] Utah was selected for two reasons. First, its CM program was implemented in a way that facilitated an empirical investigation of the program's effectiveness. Secondly, the State of Utah provided the data necessary for such an evaluation.

[2] This requirement applies to noninstitutionalized Medicaid enrollees who gained access to Medicaid benefits through their eligibility for benefits under any of the following three programs: 1) Aid to Families with Dependent Children; 2) Care for Children (a program for crippled children); and 3) Old Age Assistance. Exceptions to this rule include those Medicaid enrollees in protective custody and "lock-in" recipients (i.e., high users already assigned to a specific physician and pharmacy). Further, General Assistance recipients were not affected by these proposed restrictions. Among those eligible for this program statewide, 90 percent are AFDC recipients, 8 percent are OAA beneficiaries, and the remaining 2 percent are noninstitutionalized crippled children. (Source: Application for renewal of the waiver, 1/23/84.)

[3] The HMO option was not available in Utah County; enrollees had to select a case manager.

[4] This discussion is based upon the original waiver request, which took the form of a letter from Governor Scott M. Matheson to Richard Schweiker, Secretary of Health and Human Services, dated November 2, 1981.

[5] These may be either the initial eligibility determination proceedings or the annual review of an enrollee's continuing eligibility for Medicaid and other welfare benefits.

[6] Fruend (p. 32) points out that "if a recipient does not select a physician at the time of eligibility determination, [she or] he will be called by a health plan representative and encouraged to return to choose a primary care provider. If [she or] he does not return, however, physicians are not automatically assigned." However, Bell (1986) suggests that this type of evasion would work for only so long; eventually, such persons would be referred to the state's lock-in program for mandatory assignment by the state to a particular provider.

[7] This estimate is based upon the authors' tabulations of data obtained from the Utah Medicaid program.

[8] New Medicaid cards are mailed to enrollees each month. Printing of the case manager's name on each monthly card is now automated. However, in the early stages of the CHCD program, this information apparently was not being printed on the mailed cards (Fruend, p. 33).

[9] Unnecessary use of specialists' services was viewed as a serious and expensive problem. Accordingly, under the CHCD program, referrals to specialists required written authorization from the case manager. To facilitate monitoring of referrals to specialists, a copy of these authorizations had to be forwarded to the Medicaid program. Referrals for other services (e.g., lab tests, X-rays) did not require special written authorization from the case manager. However, all claims for referral services needed the case manager's Medicaid ID number, so unauthorized care would go unreimbursed, at least in principle.

[10] In the waiver application, state officials announced plans to contract with two physician consultants to monitor the performance of case managers. Case managers practicing "preventive" rather than "crisis" medicine would be designated as preferred physicians for the CHCD program (Neuschler). However, at least in the early months of implementation, no list of such "preferred physicians" was available for helping enrollees select a case manager (Bell, p. 40).

[11] For evenings and weekends, this access requirement implies nothing more than providing recipients with the phone number of an answering service.

[12] These preliminary findings used in support of the state's application to renew its freedom-of-choice waiver (dated 1/23/84).

[13] In fact, the preliminary state study indicated that CM management may have reduced doctor shopping substantially: CM was credited with causing the average number of different physicians seen by case-managed Medicaid clients to fall by 25 percent. (Source: renewal application, dated 1/23/84)

[14] The source is the renewal application, dated 1/23/84. For a discussion and critique of the state's assessment see the appendices.

[15] Another feasible cross-sectional research design uses observations on Medicaid clients living in counties not yet included in the CM program to establish the control group. A potential problem with this design arises from the possibility that observed differences between the treatment and control groups stem, not from case management, but from other factors correlated with county of residence.

A "before-after" (or time series) research design is also feasible with the data employed in this study. Such a design would entail comparisons of utilization or expenditure rates for Medicaid clients before and after enrollment in case management. In effect, the case managed population serves as its own control. The major drawback to this design is its underlying assumption that other factors capable of influencing recipient behavior remain constant over the relevant time period, so that any observed change in behavior is attributable to case management. The validity of this assumption is almost always problematic.

[16] Health status measures would also help control for this selection effect. However, aside from prior use information, the data reveal nothing about health status.

[17] Utilization models often contain additional variables to control for such factors as education, health status, and family size or structure. However, the data employed in this study limit the control variables to those described in the text.

[18] For details, see Appendix B.

[19] See Appendix B for additional discussion of the original data and description of the construction of the analysis database.

[20] December was selected in order to assure availability of sufficient data from earlier months for the purpose of creating the prior use variables.

[21] A nine-month prior use variable was also created. However, it produces results qualitatively identical to those obtained with the six-month prior use variable. The six-month measure is thus preferred, since it involves a less restrictive sample selection criterion and consequently yields a larger sample.

[22] The estimates reported in Table 4 assume that all other determinants of utilization equal their mean values.

[23] The interaction percentage is calculated by multiplying the two individual percentage estimates together. For instance, (32.6% x -2.4%) = -0.78%, or -0.8% after rounding.

[24] By definition, expected use per enrollee (EU) equals the product of 1) the probability of using a service (P) and 2) the predicted level of use among users (U); that is,

$$EU = P \times U.$$

From this relationship, it follows that:

$$\%chg\ EU = \%chg\ P + \%chg\ U + \text{interaction term},$$

where %chg indicates percentage change in a particular variable, and the interaction term is the product of %chg P and %chg U.

[25] The analysis does not distinguish between emergency and nonemergency use of ERs and OPDs. However, unless emergency conditions and, thus, use occurred more frequently among one of the two groups, the predictions will show differences pertaining to nonemergency use. The large sample sizes and the socioeconomic similarities between the treatment and control groups offer no reason for concern about either random or systematic differences in emergency conditions between the treatment and the control groups.

[26] The weights reflect relative program expenditures for the six services. The specific values for the weights are .256 for primary physician; .258 for specialist; .183 for hospital ER/OPD; .184 for prescription drugs; .075 for clinic-based physician; and .044 for hospital-based physician.

Appendix A

Discussion and Critique of Utah's Evaluation of the Case Management Program for Purposes of Securing the Second Waiver

As part of the application for renewal of their "freedom of choice" waiver, the State of Utah provided DHHS with an evaluation of the cost effectiveness of the CHCD program during its first year.1/ Based upon their calculations, the State of Utah claimed savings from the case management component of CHCD equal to $37 per Medicaid client, for total savings of $1.1 million per year. The savings from the HMO component of CHCD was estimated to equal another $1.1 million per year. Overall, the Utah evaluation claimed a savings of $5.40 for every $1.00 spent on the CHCD program.2/

This appendix contains a critique of the Utah cost-effectiveness evaluation, especially that part dealing with the CM program. As will be seen, the Utah evaluation of CM suffers from two basic problems. The first, and less serious, of the two problems stems from simple errors in data manipulation. Correction of these errors nearly doubles the estimated cost savings from the CM portion of CHCD. The second and more serious problem is methodological in nature. The approach Utah employed in estimating cost savings from CM is flawed logically. Correcting their methodology, without actually altering their approach fundamentally, results in a finding consistent with the one reported in the text of this report: that is, CM appears to raise costs, not lower them. The assessment concludes with a comparison between the corrected and revised Utah estimates of the cost effects of CM and the cost effects

implied by the findings reported in this study. A summary of the various cost estimates appears in Table A-1.

Errors in Data Manipulation

The estimate of a $37 savings per client reported by Utah was based, in part, on an estimate that CM actually caused an anomalous (and unexplained) $41 per client increase in lab and x-ray costs (see Table A-1). The estimate of $41 per client is wrong because of three addition errors in the Utah evaluation. The Utah evaluation reports that 9,953 people used lab or x-ray services in FY 1982; the correct total--based upon the numbers provided in the evaluation--is 10,953. Similarly, it reports 6,687 using those services in FY 1983; the correct total is 9,687. Finally, the evaluation indicates that the total payments for lab and x-ray services in FY 1983 was $718,109; the correct total is $768,109. Recalculating the cost impacts, using the Utah methodology with these correct totals, yields an estimate of a cost increase per client for lab and x-ray services of only $19. Based upon the Utah methodology, this would have produced an overall cost savings from CM equal to $59 per client. The second row of estimates in Table A-1 reflects theses corrections.

A second problem with the Utah evaluation also arises in connection with the estimates of lab and x-ray use. The evaluation claims that the number of Medicaid clients in Weber County using lab or x-ray services fell by 68 percent (from 2223 to 721) as a result of CM. Yet, no such change occurred in the

Table A-1

Comparison of Alternative Estimates of the Savings Implications of Utah's Case Management Program

Source of Estimate	Inpatient Hospital	Physician	Drugs	OPD	Lab & X-ray	Clinic		Overall Savings Per Person
				Based on Savings per Service User				
Original Utah Estimates	+ $62	+ $ 2	$ 0	+ $22	- $41	- $ 8	=	+ $37
Corrected Utah Estimates	+ $62	+ $ 2	$ 0	+ $22	- $19	- $ 8	=	+ $59
				Based on Savings per Medicaid Recipient[1]				
Utah Estimates Recalculated on a Per Recipient Basis	- $30	- $ 3	+ $ 1	+ $13	- $ 1	+ $ 5	=	- $15
Long/Settle Estimates Recalculated on a Per Recipient Basis	na	- $11	- $10	+ $ 2	na	na	=	na

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[1] "Recipient" in this context refers to a recipient of any Medicaid service.

three neighboring counties. In Davis County, the number using these services fell, but by only 5 percent. In Salt Lake and Utah Counties, the number of Medicaid clients using these services rose, by 2 percent and 8 percent respectively. Moreover, no similar drop in the use in other services was reported for Weber County. In fact, the number of clients in Weber County seeing physicians or visiting an OPD--services that are almost surely complementary with lab and x-ray use--rose by 17 and 2 percent respectively between FY 1982 and FY 1983.

These facts suggest that the number of users of lab and x-ray services in Weber County is simply misreported in the Utah evaluation. The suggestion, appearing in the Utah evaluation, that the drop in users of lab and x-ray services reflects case managers "...doing a better job of managing the clients health" is completely implausible, in light of the foregoing evidence. Rather, the reported numbers pertaining to the number of lab and x-ray users in Weber County are much more likely to reflect nothing more than an error in the data employed in the Utah evaluation.

The Utah evaluation does not contain enough information to provide an obvious basis for deriving an alternative reasonable estimate of the number of users of lab and x-ray services in Weber County. In any event, the significance of this flaw in the Utah evaluation will be seen as minor relative to the significance of the methodological problems discussed below, so

efforts to correct this particular data problem are, in the end, simply not worthwhile.[3]

Methodological Issues

The main objective of the Utah CM evaluation was to develop an estimate of the impact of CM on the cost per Medicaid recipient. This per recipient cost estimate could then be combined with an estimate of the total number of recipients to compute an estimate of the total dollar impact of case management. While the Utah evaluation claims to have estimated costs on a per recipient basis, the estimates reported in the evaluation are, in fact, something else entirely.

The Utah methodology employed the following procedure. First, it develops a county-by-county estimate of the cost effects of CM on a per user basis. These county estimates are then combined, in a weighted average, to provide an overall estimate of the average savings (or loss) per user for that service. To illustrate, the estimates of the effect of CM on inpatient hospital costs reveal an average savings of $62 (see Table A-1; either row 1 or 2); this estimate applies to users of inpatient services only, not to all enrollees. Similarly, the estimate for physician services applies to users of those services, not to all recipients.

The second step in the Utah methodology is to add--with no special weighting--all of the estimates for each of the individual services, computed on a per user basis, to derive an estimate of overall cost impacts per client. It is at this point

that the methodological error occurs. Adding the costs-per-user (as is done, for example, in rows 1 and 2 in Table A-1) clearly does not yield an overall cost estimate that applies to the entire recipient population, since the number of users for any one service is usually a fraction--sometimes a small fraction--of the total recipient population. In fact, since the number of users varies across the services, it is not clear to which group, if any, the overall Utah cost estimates apply.

An illustration may help fix ideas. Consider a Medicaid program serving 30,000 recipients (approximately the number in the four-county Utah area under consideration here). Assume that during a typical year 20 percent, or 6,000, use inpatient hospital services while 90 percent, or 27,000, use physician services. (For purposes of this illustration, ignore all other services.) Next, imagine that case management is found to reduce inpatient hospital costs by $62 per user (that is, for the 6,000 users of inpatient services), while lowering the cost of physician services by $2 per user (that is, for the 27,000). (These cost savings are the ones actually estimated by Utah; see Table A-1.) The Utah methodology would simply add these two cost saving together to get $64 as the savings per recipient. Applying this estimate to the entire recipient population yields an aggregate savings of $1.92 million ($64 x 30,000 recipients).

This estimate is clearly inappropriate. Most recipients do not use inpatient hospital services, so the $62 savings does not

apply to them. Similarly, for those not using physician services, case management will save nothing.

An appropriate way to estimate total savings (and still retain the spirit of the Utah approach) is to compute the savings on the basis of the total recipient population. Thus, while the estimated savings per user of inpatient hospital services is $62, the expected savings per recipient is $12.40; that is, the savings per user times the probability that any given recipient of Medicaid services will use inpatient services (or $62 x 0.2 = $12.40). By the same token, the appropriate estimate for the per recipient savings on physician services is $1.80 (= $2.00 x 0.9), rather than $2. These two estimates can properly be added together, since they apply to the same population. Thus, the correct estimated cost savings per recipient would be $14.20 (= $12.40 + $1.80), rather than the $64 implied by the Utah methodology.

When this appropriate methodology is applied to the data provided in the Utah evaluation, the results are indeed dramatic. Recall that the (corrected) Utah estimate was that CM saved $59 per recipient, for a total of about $1.76 million per year. Using the proper methodology for computing per recipient costs (and accepting all remaining assumptions underlying the Utah approach) yields a finding that CM actually raises costs by $15 per recipient (see Table A-1, row 3), or by a total of about $446,000 per year.

While there are other aspects of the Utah evaluation that could be criticized, they are less important than the foregoing methodological problem.4/In light of the significance of this basic error in the Utah evaluation, it seems that little would be accomplished by going any further in this assessment of the Utah evaluation.

A Partial Comparison of Estimated Impacts of CM

A limited comparison between the findings of the Utah evaluation and those reported in the present study is possible. The comparison is a limited one because the service categories employed in the Utah evaluation do not match perfectly those used in this study. In particular, it is feasible to compare estimated cost savings for the following services only: 1) physician services (primary care physician and specialist services combined); 2) drugs; and 3) OPD services.

The cost estimates for the present study are derived from the estimates reported in Table 4, along with some of the aggregate expenditure data provided in the Utah evaluation. An illustration will help describe the method for deriving these cost estimates. Consider the category of prescription drugs. Table 4 shows that case management raises expected dollar claims per case-managed enrollee by 42.4 percent; that is, other things equal, if the average expenditure on a nonCM client is $X per year, then the average expenditure on a CM client would be $1.424X. The Utah evaluation indicates that the actual average expenditure for drugs for CM and nonCM clients combined was $100

in FY 1983.[5] In other words, the overall figure of \$100 is a weighted average of the per client expenditures on the CM and nonCM subpopulations, where the weights reflect the relative sizes of the two groups.

In equation form, this relationship can be expressed as:

$$\$100 = w_{cm}(\$1.424X) + wn(\$X),$$

where w_{cm} indicates the proportion of the Medicaid population that was case managed in FY 1983; w_n indicates the proportion that was not case managed (of course, the two weights add to 1); \$X is the average drug expenditures for the nonCM group; and \$1.424X is the average drug expenditure for the CM group.

With the available data, it is not possible to know with certainty the actual values for the weights. It is clear, however, that w_{cm} is less than 0.5. Utah's fiscal year ends on June 30. Thus, FY 1983 covers the period from July 1, 1982 through June 30, 1983. By December 1983, enrollment in CM was only 50 percent of the eligible population (see the text of the report). Accordingly, the enrollment percentage for FY 1983 must have been substantially less than 50 percent. This hypothesis receives further support from the fact that CM was in operation for only part of FY 1983, so for some of the fiscal year no one was covered by CM. Case management began in August 1982 in Salt Lake County, October 1982 in Davis and Weber Counties, and January 1983 in Utah County. For purposes of developing cost estimates comparable to those provided in the Utah evaluation, it is assumed that an average of 25 percent of the eligible

population in these four counties was covered by CM during FY 1983.

Using weights of 0.25 for the CM group and 0.75 for the nonCM group yields an estimate of $90.42 in drug expenditures per nonCM client and $128.75 (= 1.424 x $90.42) per CM client, for a dollar cost differential per CM client of $38.33. This estimate translates into an aggregate cost of about $285,000, based upon the Utah statement that the total number eligible for CM during FY 1983 was 29,760 [$285,000 = ($38.33) x (.25) x (29,760)]. Spreading this cost increase of $285,000 across the entire eligible population of 29,760 implies a per enrollee cost of $9.58 (= 285,000/29,760). This number is comparable to the numbers reported in the Utah evaluation.

The last row of Table A-1 contains the cost estimates (rounded to the nearest dollar) implied by the results reported in Table 4. While the Long/Settle cost estimates bear some rough similarity to the (corrected and revised) Utah cost estimates (reported in row 3 of Table A-1), they nevertheless portray CM as a substantially more costly program, at least in connection with the three services where direct comparisons are possible. For physician services, the Utah estimate implies a cost increase of approximately $89,000, while the Long/Settle estimate suggests an increase in program costs of about $327,000. In connection with drugs, the Utah estimate implies a program savings of nearly $30,000; in contrast, the Long/Settle estimate indicates that program costs should rise by almost $298,000. Finally, the

savings in outlays on OPD services implied by the Utah estimate is approximately $387,000, whereas the Long/Settle estimate suggests an overall cost savings of much less, somewhere around $60,000 per year. On balance, for these three services, the Utah findings show a total program savings of slightly more than $327,000 annually, while the Long/Settle results reveal an increase in total program costs of more than $565,000 per year.

[1] The waiver renewal application is dated January 23, 1984. It was submitted by Carol J. Thomas, Program Director, to Darrel Muhr, Associate Regional Administrator, Division of Program Operations. Utah's initial evaluation of its freedom-of-choice program accompanied the application. Additional information was submitted by Utah to Elmer Smith, HCFA; no date was indicated on this supporting material.

[2] The evaluation states that $4.40 is saved for every $1.00 in administrative expenses. However, their own numbers make it clear that their findings are most appropriately described as showing a savings of $5.40 per $1.00 spent, not $4.40. (See page 6 of the Utah evaluation.)

[3] The potential significance of the problem is easily illustrated however. Both the original and the "corrected" estimates reported in Table 1 (see the first two rows of estimates) are based, in part, on the apparent erroneous data on the number of users of lab and x-ray services in Weber County. Thus, the estimate of an overall cost savings of $59 per client depends partly on the assumption that the number of lab and x-ray users in Weber County fell from 2234 in FY 1982 to 721 in FY 1983. Based upon the experience of the neighboring counties, it is far more reasonable to assume that the number of users of these services did not decline at all. If in fact this was what happened, the Utah evaluation should have reported an overall cost savings of $71 per client, rather than $59 per client.

[4] For example, the data employed in the Utah evaluation pertain not only to the case managed population, but also to some subpopulations (such as General Assistance recipients) not even eligible for case management. Further, the evaluation does not consider the fact that case management covered only a fraction of the potential case-managed population during the time period covered by the analysis. The two foregoing problems interfere with measuring accurately the effect of case management. Another potentially important problem stems from the method Utah employed for forecasting what expenditures per person would have been in FY 1983 in the absence of case management. The evaluation simply extrapolates the FY 1982 cost figures by applying an inflation factor to them. These extrapolated figures are them compared to the actual FY 1983 cost figures to arrive at the estimated impact of case management. This approach depends on the highly questionable assumption that all observed differences between actual and predicted FY 1983 costs are attributable to case management.

[5] The Utah evaluation actually reports an expenditure figure of $101. However, correct addition of the numbers in the evaluation yields $100.

APPENDIX B

CONSTRUCTION OF THE ANALYSIS FILES

I. IMPLICATIONS OF THE RESEARCH DESIGN FOR DATABASE CONSTRUCTION

Utah began its Case Management Program for Medicaid clients in July 1982 in four counties: Utah, Salt Lake, Weber, and Davis, all in the Salt Lake City metropolitan area. The actual program was preceded by a pilot program in Ogden County that began in December of the previous year. Between July and October 1982, only new clients were enrolled, and all efforts were directed toward enrollment for the subsequent year. No reviews of case management status were conducted until November 1983.

A cross-sectional research design is used in the present study, focusing on individual clients and on utilization of services and expenditures by those included in case management versus those who were not included. Since the principal vehicles of the analysis are utilization and expenditure equations, detail is required on spending by type of service and by type of provider. The Utah data are rich in such service-level detail.

In addition, detail on individual characteristics of clients are required to control for the possibility that recruitment to case management is related to characteristics that are themselves related to use of medical care services. Such characteristics include demographic variables--for example, age, sex and race-ethnicity--and use of medical services prior to the analysis period. The latter variable may be considered in part as a proxy for health status information not available on the data set.

II. THE DATA

The cross-sectional design of the analysis requires two types of files: a service-level file, containing a record for each service used by each recipient of services, and a person-level file containing a single record for each person that describes characteristics of that person. The Medicaid Management Information System (MMIS) data obtained from the Utah program were not at either level. Rather, they were at claims level, so that each person might have numerous claim records. On the one hand, some claim records contained numerous individual services. On the other hand, for some individual services there were several claims, reflecting adjustments to an original claim. This meant that data on individual characteristics had to be stripped off and aggregated into a person file containing only one record per unique recipient, while data relating to services used had to be stripped off and either disaggregated or aggregated to the individual service level. Such a level of service disaggregation allows maximum flexibility in the choice of analysis unit.

In addition, the data--which contained a total of 5.2 million claim-level records--came from two partially overlapping MMIS periods, each with its own data elements and file layouts. Case management information was available only on records entered under the new system.

The 2.05 million records formatted under the new system spanned a period from approximately August 1982 through August

1984 and represented service dates from roughly September 1982 through April 1984. The distribution of these claims records by year is as follows:

Year	Number of Claims
1982	261,965
1983	1,287,261
1984	494,527

Only records entered after August 1983 contained information on enrollment in case management, however.

These records were of six different types, only three of which--medical, institutional, and pharmaceutical--actually contain service utilization and expenditure information. Other claims interleaved with the utilization identified information on mass adjustments of reimbursements, presence of prior authorization of services, and cases in which Medicare is the first payer. The breakdown of claims for the new system by type of claim is as follows:

Type of Claim	Number of Claims
Medical	683,077
Institutional	119,482
Pharmaceutical	1,071,969
Other	179,225

III. THE TIME FRAME

Ideally, an enrollment file would be used to identify persons eligible for Medicaid but using no services. However, an

enrollment file was not available, so the person-level file described above, which is really a recipient file, was the closest possible approximation. In order to be able to draw both users and "nonusers" of services from such a file, it was necessary to define a time period for analysis during which some recipients could be observed using services and others could be inferred to be enrolled but not using services.

In order to select a time period suitable for analysis, it was necessary to find a time "frame" during which case management was in effect and an analysis "window" within the chosen frame. This allowed observation both of persons who used services during the analysis window and of persons who appeared to be eligible but used no services. The analysis window selected was December 1983, the most recent month both preceded and followed by three complete months of data--the frame for the analysis window.

This strategy allowed inclusion of 1) users, defined as those with paid claims in the December 1983 window, and 2) nonusers, defined as those who used services at some time in both the preceding three months and the following three months but who used no services in December 1983. The logic behind such a definition of nonusers was that if an individual was observed using services within a reasonably narrow period both prior to and after December, then eligibility for Medicaid was likely to have spanned December. The number of claim-level records remaining by type of record after the time frame was defined is as follows:

Type of Record	Number of Record
Medical	222,687
Institutional	8,258
Pharmacy	231,994
Other	2,141

IV. THE PROCESS OF CONSTRUCTING PERSON RECORDS

Since the Utah data initially were at claim level, person-level files had to be constructed using a recipient identification number included in each claim record. Where each personal characteristic variable has a single value across all claims for a given individual, this process is a relatively simple one. However, values were not always consistent across claims where individuals had multiple claim records. Such inconsistencies could result, for example, because some data items were omitted from some claims or because of key-punching errors. In such cases, routines had to be developed for locating and flagging inconsistencies so the analysts could make a decision as to whether a single "clean" value reasonably could be assigned for a given recipient identification number.

The following are the personal characteristic variables constructed for the personal-level files, with a brief description of the type of inconsistencies that occurred for each and the way in which inconsistent values were coded. If all cases with inconsistencies are included, there are 15,186 potential members of the final recipient file. The ultimate size

of the recipient file will depend on the stringency of selection criteria used. About 1,100 individuals would be excluded if the most stringent criteria are applied.

Case Management: This variable is a dummy variable having a value of one if a person was enrolled in case management and zero otherwise. Information from Utah program officials indicated that no one was removed from case management during the period of interest, so all persons should have had a continuous period of enrollment once enrolled. However, when claims were arranged chronologically, some individuals appeared to have left case management. In order to locate such individuals, claims were arranged by recipient identification number and by service date. The earliest date on which each individual was identified as having received services under case management was then compared with the latest date that individual was identified as receiving services but not being enrolled in case management. Discrepancies were then flagged. Only 196 of 15,186 potential members of the final recipient file had a discrepancy.

Age: This variable was constructed from date of birth information contained on claim records because it appeared to be more reliable than an explicit age variable that also appeared. However, because of the large errors that could occur if a single digit of this date was entered incorrectly, even this more reliable variable was susceptible to inconsistencies. In order to examine the extent of the consistencies, mean, median, modal, minimum and maximum dates were constructed for each person. The

number of person records with inconsistent birth dates ultimately will depend on the decision rule selected. For example, one possible rule is assign the most frequently occurring date if it also is the median date. Under that rule, only 18 cases would be excluded. Only 326 potential members of the person file had any type of inconsistency.

Sex: Inconsistencies in this variable included nonsense values, missing values, and more than one valid sex value. Because of the number of different types on inconsistencies possible, a variable was constructed that identifies the degree of reliability of the sex variable. The highest reliability was assigned to cases where either male or female was the only nonmissing value. Only 168 cases failed to meet this criterion. Where multiple nonmissing values occurred, two other rankings were constructed: sex is recorded as male or female on more than two-thirds of the claims for an individual, and sex is recorded as male or female on more than half the claims for an individual. The final ranking was ties, for which no reliable determination can be made.

Race/Ethnicity: The procedure used for assignment of race/ethnicity where inconsistencies occurred was similar to that just described for the sex variable, except that many more categories of race/ethnicity were included on claims than are of interest for this analysis. Once categories were combined into the four wanted for this analysis--white, black, hispanic origin, and other--recipients again were assigned a reliability ranked

value, with the most restrictive criterion being that an individual have only one nonmissing value for race/ethnicity. Only 368 potential members of the recipient file fail this criterion.

Aid Category: A decision was made to include only recipients eligible for Medicaid because of eligibility for Aid to Families with Dependent Children (AFDC). This is the most common source of eligibility and selection of the single eligibility group yields a more homogeneous sample of persons for analysis. However, in some cases persons who met the AFDC criterion also were recorded as being eligible under another program. Again, nearly all the potential members of the final recipient file, 14,162 individuals, met the most restrictive criterion of having only AFDC eligibility.

County of Residence in December: Although each claim contained information about county residence, the research strategy of constructing a set of December users and nonusers of services posed special problems for assignment of a residence in December. That is, since nonusers had no December claims, a December residence had to be inferred by comparing claims on either side of December. In addition, since residence is not a fixed characteristic like sex or race, it is more difficult to determine which inconsistencies reflect actual changes of residence and which are simple errors, even for those with December claims. Fortunately, 14,276 persons had only one residence throughout the entire span of data. For these persons

assignment was straightforward. Among the 910 cases with multiple counties of residence, an additional 749 had only one residence during the seven-month analysis frame. Of the remaining 161 persons with multiple residences during the analysis frame, 52 had December claims from which a "combination" residence value could be determined directly. None of these persons had more than two reported residences for December. The remaining 109 "nonusers" were assigned a combination December residence based on examination of the most recent claim prior to December and the first claim after December.

Prior Utilization: Measures of total expenditures for all services in the three, six, and nine month periods prior to December 1983 were created for each case that had been a Medicaid recipient for a period in excess of the respective number of months. For example, the six month prior use variable is the sum of all paid claim amounts, regardless of service type, for the period June 1, 1983 through November 31, 1983. The variable is constructed, however, only for those cases having one or more paid claims in the period January 1, 1983 through May 31, 1983. The point of this restriction--analogous to the use of the "window" in identifying nonusers in December--is to distinguish the apparently continuous enrollees, who should be included in the analysis, from those with fewer than six months of eligibility, who should be excluded in order to have an unbiased measure of prior use. The three, six, and nine month variables reduce the analysis sample from 10,889 (after applying all other

exclusions) to 9,010, 7,899, and 6,701 respectively. Therefore, the analyst must trade the advantage of a longer prior use period against the disadvantage of smaller samples. This report concentrates on the six month variable; the results are virtually identical when either the three or nine month variable is substituted.

V. THE PROCESS OF CREATING CLEAN CLAIMS FILES

The second and by far more difficult task in file construction was the cleaning of the service information contained on the original claim records. There are two major reasons why the full claims file as received was not in a form suitable for the present analysis . First, the MMIS serves primarily an accounting function. Records of all transactions, both debits and credits, relating to a given claim are included. Second, a number of types of "claim" entries other than actual paid claims appear. Examples are history records, records for mass provider reimbursement adjustments and records relating to prior authorization of services. The present analysis requires a single, correct record for each claim.

The first "cleaning" job was the exclusion of all of the latter types of nonclaim records, generally, the 2,141 "other" records listed in the analysis frame table above, plus history and other non-claim records form the medical, institutional and pharmacy categories.

Second, the auxiliary records--incorrect initial records, and adjustment records--associated with actual paid claims had to

be stripped out. This task was made more complicated because not all who entered correction records followed the same routine. That is, rather than having an initial entry, a correction that removed the initial entry and then a third record that entered the correct claim, some corrected claims had two, four or five related entries. Since no general pattern appeared to identify the correct claim from these "odd-lot" entries, they were excluded. Only claims that had never been corrected and sets of three entries from which the correct final record could be identified readily were retained in the sample from which the claims for analysis were drawn. However, these two categories included easily the bulk of claims in the analysis frame. Of the 465,000 claims in the analysis frame, 430,215 were correct single claim records, and another 26,193 represented sets of three, from which 8,731 final corrected claims were selected.

The final task in creation of the service-level file for analysis was disaggregation of each claim record into a set of single service records containing information about the service used, the date of service, the type of provider, and the amount of payment. This process can best be understood by understanding the structure of a claim record. Each claim record contains a "front-end-header" that identifies the recipient and other information that pertains to the entire record. After this header, one or more repeating segments may occur, each relating to a particular service included in the single billing represented by the claim record. Thus, the length of each claim

record varies depending on the number of services included in the billing. Disaggregation entailed stripping off the front end header, stripping off each of the repeating segments and then reattaching a copy of the front end header to each individual service segment to create a new record for each service. This level of disaggregation allows reaggregation for analysis to any level chosen by the analyst, for instance, by date, by type of service, by provider type, and so forth.

Appendix C

The Estimated Equations

The following tables report the parameters estimated from the statistical models discussed in the text. The first six tables comprise the probit estimates of the probability of using a particular service during December 1983. The remaining six tables comprise the ordinary least squares estimates of the level of spending by users of each service, where spending is expressed in its natural logarithm. Each set of six tables applies to the following services, respectively:

- primary care physicians
- specialty care physicians
- hospital outpatient department and emergency room
- prescription drugs
- clinic-based physicians' services
- hospital-based physicians' services

Probit Equation, on Use

PRIMARY CARE PHYSICIANS

```
*********  SUMMARY OF ESTIMATION RESULTS  ********


 VARIABLE        ML ESTIMATE        ASYMPTOTIC          ASYMPTOTIC        PROBABILITY
 ID   NAME       OF PARAMETER     STANDARD ERROR        "T"-RATIO         T > T-RATIO

X-42 CONSTANT       -1.766038         0.086827          -20.362847          0.000001
X- 2 CMI             0.182192         0.036209            5.031727          0.000001
X- 3 PRUSE6          0.103455         0.012723            8.131403          0.000000
X- 5 KIDLT1          0.646554         0.083432            7.749477          0.000000
X- 6 KID14           0.192246         0.049404            3.891297          0.000101
X- 7 KID511         -0.131915         0.055647           -2.370579          0.017784
X- 8 F1217          -0.121802         0.083505           -1.458622          0.144709
X- 9 F1824          -0.137769         0.054499           -2.527942          0.011493
X-11 F4564           0.003429         0.128940            0.026592          0.978786
X-12 M1217          -0.603315         0.124914           -4.829844          0.000002
X-13 M1824          -0.688322         0.551113           -1.248968          0.211714
X-14 M2544          -0.169192         0.166044           -1.018960          0.308254
X-15 M4564          -0.795732         0.345900           -2.300470          0.021448
X-17 BLACK          -0.094077         0.102950           -0.913806          0.360847
X-18 LATINO         -0.041790         0.054030           -0.773462          0.439273
X-19 OTHRAC         -0.037375         0.117029           -0.319367          0.749457
X-20 DAVIS           0.424452         0.060014            7.072519          0.000000
X-22 UTAH            0.396896         0.044093            9.001361          0.000000
X-23 WEEEI           0.215818         0.045076            4.787865          0.000002

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PREDICTED PROBIT (Y=X.B) =   -0.99343
     CUM PROBABILITY P(Y)     =    0.16025
     NORMAL DENSITY  Z(Y)     =    0.24356
     HAZARD RATE Z(Y)/Q(Y)    =    0.29004

MEAN PREDICTED VALUES OVER ALL CASES
     AVERAGE PROBABILITY P(Y) =    0.17220
     AVERAGE HAZARD RATE      =    0.30520
     MEAN SQUARED ERROR OF P  =    0.13602


TOTAL OBS  7899;  NON-LIMITS= 1360;  LIMITS= 6539;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDITIONAL LOG-LIKELIHOOD FN =  -3628.14
 CONDITIONAL   LOG-LIKELIHOOD FN =  -3454.50
 LOG OF LIKELIHOOD RATIO         =  -173.642

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0 * LOG OF LIKELIHOOD RATIO)  =     347.28
    PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

Probit Equation, on Use

SPECIALISTS

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*********  SUMMARY OF ESTIMATION RESULTS  *********

 VARIABLE          ML ESTIMATE       ASYMPTOTIC          ASYMPTOTIC        PROBABILITY
_ID  _NAME___     OF_PARAMETER_    STANDARD_ERROR      __"T"-RATIO_      _T_>_T-RATIO

X-42 CONSTANT        -2.216551         0.104828          -21.144748          0.000000
X- 2 CHI              0.063684         0.044130            1.443080          0.149038
X- 3 FRUSE6           0.181442         0.015190           11.945207          0.000000
X- 5 KIDL11          -0.326582         0.124814           -2.616549          0.008900
X- 6 KID11           -0.251539         0.062033           -4.054927          0.000051
X- 7 KIDS11          -0.404992         0.071468           -5.666792          0.000000
X- 8 F121            -0.077869         0.092494           -0.841888          0.399876
X- 9 F182            -0.182668         0.061335           -2.978228          0.002908
X-11 F456            -0.136276         0.147236           -0.925548          0.354709
X-12 M121            -0.197938         0.118328           -1.672792          0.094408
X-13 M182             0.509989         0.383003            1.331552          0.183046
X-14 M254             0.445839         0.148646            2.999326          0.002714
X-15 M456             0.151343         0.242486            0.624130          0.532560
X-17 BLACK           -0.117610         0.125912           -0.934069          0.350297
X-18 LATINO          -0.128538         0.068742           -1.869855          0.061541
X-19 OTHRAC           0.036554         0.130796            0.279474          0.779888
X-20 DAVIS            0.019156         0.077034            0.248667          0.803625
X-22 UTAH            -0.081152         0.058002           -1.399125          0.161815
X-23 WEBER            0.112098         0.053208            2.106784          0.035168

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PREDICTED PROBIT (Y=X.B) =   -1.45158
     CUM PROBABILITY P(Y)     =    0.07331
     NORMAL DENSITY  Z(Y)     =    0.13911
     HAZARD RATE Z(Y)/C(Y)    =    0.15012

MEAN PREDICTED VALUES OVER ALL CASES
     AVERAGE PROBABILITY P(Y) =    0.08609
     AVERAGE HAZARD RATE      =    0.16726
     MEAN SQUARED ERROR OF P  =    0.75096D-01


TOTAL OBS= 7899;  NON-LIMITS=  680;  LIMITS= 7219;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDITIONAL LOG-LIKELIHOOD FN =  -2317.48
 CONDITIONAL   LOG-LIKELIHOOD FN =  -2163.66
 LOG OF LIKELIHOOD RATIO         =  -153.824

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0 * LOG OF LIKELIHOOD RATIO)   =     307.65
    PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

Probit Equation, on Use

OPD + ER

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*********  SUMMARY OF ESTIMATION RESULTS  *********

 VARIABLE        ML ESTIMATE      ASYMPTOTIC         ASYMPTOTIC        PROBABILITY
 ID   NAME       OF PARAMETER   STANDARD ERROR       "T"-RATIO        T > T-RATIO

X-42 CONSTANT      -2.139346        0.107408         -19.917880         0.000001
X- 2 CHI            0.117611        0.044603           2.636821         0.008385
X- 3 PRUSE6         0.142529        0.015555           9.162982         0.000000
X- 5 KIDL18         0.115706        0.108564           1.065787         0.286553
X- 6 KID14         -0.050290        0.062406          -0.805853         0.420352
X- 7 KIDS 1        -0.334504        0.074744          -4.475323         0.000008
X- 8 F121           0.041524        0.093840           0.442496         0.658143
X- 9 F182           0.071850        0.061283           1.172424         0.241063
X-11 F456          -0.007134        0.148570          -0.048016         0.961705
X-12 M121          -0.490410        0.154433          -3.175552         0.001501
X-13 M182           0.501320        0.388052           1.291889         0.196434
X-14 M254           0.174268        0.170752           1.020588         0.307482
X-15 M456           0.541660        0.225561           2.401388         0.016356
X-17 BLAC          -0.046452        0.125021          -0.371554         0.710235
X-18 LATI C         0.022958        0.064935           0.353547         0.723688
X-19 OTHR C         0.007869        0.136402           0.057687         0.954000
X-20 DAVI          -0.121252        0.080655          -1.503265         0.132811
X-22 UTAH          -0.108297        0.057504          -1.883283         0.059699
X-23 WEBE          -0.105169        0.055519          -1.894284         0.058224

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PRED CTED PROBIT (Y=X.B) =  -1.46443
     CUM  ROBABILITY P(Y)     =   0.07154
     NORM L DENSITY  Z(Y)     =   0.13653
     HAZA  C RATE Z(Y)/C(Y)   =   0.14705

MEAN PRED CTED VALUES OVER ALL CASES
     AVER GE PROBABILITY P(Y) =   0.08089
     AVER GE HAZARD RATE      =   0.15977
     MEAN SQUARED ERROR OF P  =   0.72405C-01


TOTAL OBS= 7899;  NON-LIMITS=  639;  LIMITS= 7260;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDIT ONAL LOG-LIKELIHOOD FN =  -2219.25
 CONDITIONAL   LOG-LIKELIHOOD FN =  -2117.38
 LOG OF LIKELIHOOD RATIO         =  -101.871

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0 * LOG OF LIKELIHOOD RATIO)   =     203.74
   PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

Probit Equation, on Use

PRESCRIPTION DRUGS

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**********  SUMMARY OF ESTIMATION RESULTS  ********

 VARIABLE         ML ESTIMATE        ASYMPTOTIC           ASYMPTOTIC        PROBABILITY
 ID   NAME        OF PARAMETER     STANDARD ERROR        "T"-RATIO        |T|>T-RATIO

X-42 CONSTANT      -0.924581         0.073061          -12.654889          0.000000
X- 2 CM1            0.344096         0.030987           11.104638          0.000000
X- 3 PRUSE6         0.128865         0.010940           11.779202          0.000000
X- 5 KIDLT1        -0.126204         0.079971           -1.578127          0.114577
X- 6 KID14         -0.381369         0.043645           -8.737910          0.000000
X- 7 KID511        -0.547690         0.047400          -11.554651          0.000000
X- 8 F1217         -0.446679         0.069851           -6.394763          0.000000
X- 9 F1824          0.013096         0.045512            0.287751          0.773545
X-11 F4564          0.350596         0.113275            3.095084          0.001975
X-12 M1217         -0.889777         0.093429           -9.523596          0.000000
X-13 M1824         -0.857652         0.383645           -2.235532          0.025410
X-14 M254          -0.012166         0.136512           -0.089123          0.928986
X-15 M4564          0.511681         0.211108            2.423786          0.015382
X-17 BLACK         -0.212411         0.087910           -2.416231          0.015705
X-18 LATINO        -0.136632         0.046565           -2.934252          0.003353
X-19 OTHRAC        -0.308301         0.099857           -3.087415          0.002026
X-20 DAVIS          0.193846         0.054275            3.571524          0.000357
X-22 UTAH           0.065057         0.039275            1.656466          0.097667
X-23 WEBE           0.113945         0.038806            2.936246          0.003332

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PREDICTED PROBIT (Y=X.B) =   -0.28700
     CUM PROBABILITY P(Y)     =    0.38706
     NORMAL DENSITY  Z(Y)     =    0.38285
     HAZARD RATE Z(Y)/G(Y)    =    0.62460

MEAN PREDICTED VALUES OVER ALL CASES
     AVERAGE PROBABILITY P(Y) =    0.39650
     AVERAGE HAZARD RATE      =    0.64771
     MEAN SQUARED ERROR OF P  =    0.21556


TOTAL OBS: 7899;   NON-LIMITS= 3133;  LIMITS= 4766;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDITIONAL LOG-LIKELIHOOD FN =  -5305.15
 CONDITIONAL   LOG-LIKELIHOOD FN =  -4896.09
 LOG OF LIKELIHOOD RATIO         =  -409.057

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0 * LOG OF LIKELIHOOD RATIO)   =     818.11
    PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

Probit Equation, on Use

CLINIC-BASED PHYSICIANS

```
*********** SUMMARY OF ESTIMATION RESULTS *********

 VARIABLE         ML ESTIMATE         ASYMPTOTIC          ASYMPTOTIC        PROBABILITY
 ID   NAME        OF PARAMETER      STANDARD ERROR        'T'-RATIO        T > T-RATIO

X-42 CONSTANT        -2.267350          0.124888          -18.155090          0.000001
X- 2 CMI              0.250387          0.052181            4.798457          0.000002
X- 3 PRUSE6           0.120209          0.017953            6.695639          0.000000
X- 5 KIDLT1           0.487586          0.113149            4.309226          0.000017
X- 6 KID14            0.155918          0.070857            2.200453          0.027804
X- 7 KID511          -0.162753          0.085977           -1.892984          0.058397
X- 8 F1217            0.167739          0.106126            1.580560          0.114019
X- 9 F1824            0.090891          0.072906            1.246680          0.212552
X-11 F4564            0.293034          0.155346            1.886336          0.059287
X-12 M1217           -0.442760          0.190504           -2.324154          0.020143
X-13 M1824            0.119860          0.514559            0.232938          0.815816
X-14 M2544           -0.116970          0.243307           -0.480750          0.630708
X-15 M4564            0.586641          0.254916            2.301314          0.021400
X-17 BLACK            0.067743          0.124585            0.543753          0.586627
X-18 LATINO          -0.187783          0.077481           -2.423598          0.015390
X-19 OTHRAC          -0.213628          0.177895           -1.200865          0.229840
X-20 DAVIS           -0.248553          0.092951           -2.674035          0.007510
X-22 UTAH            -0.908682          0.100976           -8.999033          0.000000
X-23 WEBER           -0.144483          0.059110           -2.444300          0.014535

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PREDICTED PROBIT (Y=X.B) =  -1.72751
     CUM PROBABILITY P(Y)     =   0.04204
     NORMAL DENSITY  Z(Y)     =   0.08972
     HAZARD RATE Z(Y)/Q(Y)    =   0.09366

MEAN PREDICTED VALUES OVER ALL CASES
     AVERAGE PROBABILITY P(Y) =   0.05721
     AVERAGE HAZARD RATE      =   0.11183
     MEAN SQUARED ERROR OF P  =   0.52171D-01



TOTAL OBS: 7899;  NON-LIMITS=  452;  LIMITS= 7447;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDITIONAL LOG-LIKELIHOOD FN =  -1731.50
 CONDITIONAL   LOG-LIKELIHOOD FN =  -1598.17
 LOG OF LIKELIHOOD RATIO         =  -133.33

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0 * LOG OF LIKELIHOOD RATIO)   =    266.66
    PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

Probit Equation, in Use

HOSPITAL-BASED PHYSICIANS

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*********  SUMMARY OF ESTIMATION RESULTS  *********


 VARIABLE         ML ESTIMATE       ASYMPTOTIC        ASYMPTOTIC       PROBABILITY
_ID_ _NAME___    OF_PARAMETER_    STANDARD_ERROR    ___"T"-RATIO_     _T_>_T-RATIO

X-42 CONSTANT      -2.327471         0.135987        -17.115390          0.000001
X- 2 CHI            0.178544         0.056223          3.175656          0.001501
X- 3 PRUSE6         0.131787         0.019609          6.720578          0.000000
X- 5 KIDLT1         0.265319         0.130353          2.035386          0.041846
X- 6 KID 4          0.037116         0.078404          0.473387          0.635950
X- 7 KID511        -0.421648         0.102488         -4.114129          0.000039
X- 8 F1217          0.011515         0.119023          0.096749          0.922928
X- 9 F1824          0.181530         0.075711          2.397690          0.016522
X-11 F4554         -0.158629         0.197578         -0.802869          0.422075
X-12 M12 7         -0.336807         0.184554         -1.824976          0.068043
X-13 M1824         -2.407847         6.895451         -0.349194          0.726953
X-14 M2544          0.280228         0.205345          1.364669          0.172397
X-15 M4554          0.529161         0.272167          1.944252          0.051901
X-17 BLACK          0.018008         0.163109          0.110405          0.912091
X-18 LATINO         0.091072         0.082371          1.105626          0.268922
X-19 OTHRAC        -0.070657         0.173523         -0.407190          0.683880
X-20 DAVIS         -0.390160         0.106392         -3.667191          0.000247
X-22 UTAH          -0.243307         0.068435         -3.555325          0.000380
X-23 WEBER         -1.352501         0.158732         -8.520654          0.000000

PREDICTED VALUES AT MEAN VALUE LOCUS:
     PREDICTED PROBIT (Y=X.B) =  -1.94450
     CUM PROBABILITY P(Y)     =   0.02598
     NORMAL DENSITY  Z(Y)     =   0.06024
     HAZARD RATE Z(Y)/Q(Y)    =   0.06184

MEAN PREDICTED VALUES OVER ALL CASES
     AVERAGE PROBABILITY P(Y) =   0.04470
     AVERAGE HAZARD RATE      =   0.92950D-01
     MEAN  SQUARED ERROR OF P =   0.41161D-01


TOTAL OBS = 7899;   NON-LIMITS=   353;  LIMITS= 7546;     NUMBER OF VARIABLES IN EQUATION = 19

 UNCONDITIONAL LOG-LIKELIHOOD FN =  -1442.12
 CONDITIONAL    LOG-LIKELIHOOD FN =  -1293.00
 LOG OF LIKELIHOOD RATIO           =  -149.124

LIKELIHOOD-RATIO CHI-SQUARED STATISTIC FOR OVERALL TEST OF REGRESSION
    (-2.0) * LOG OF LIKELIHOOD RATIO)   =     298.25
    PROB OF CHI-SQUARE >  X WITH 18 D.F. = 0.0
```

OLS Spending Equation, for users

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                                              REG: PRIMARY CARE USE.

DEP VARIABLE: DOCCL1

                   SUM OF          MEAN
SOURCE     DF     SQUARES        SQUARE       F VALUE      PROB>F

MODEL      18     133.597      7.422028         9.451      0.0001
ERROR    1341    1053.071      0.785288
C TOTAL  1359    1186.667

   ROOT MSE      0.886165      R-SQUARE        0.1126
   DEP MEAN      3.366448      ADJ R-SQ        0.1007
   C.V.          26.32343

                PARAMETER      STANDARD    T FOR H0:                          VARIABLE
VARIABLE   DF    ESTIMATE         ERROR  PARAMETER=0   PROB > |T|              LABEL

INTERCEP    1    3.468941      0.126307       27.464       0.0001  INTERCEPT
CMI         1   -0.024445      0.052692       -0.464       0.6428  CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6      1    0.022872      0.018395        1.243       0.2139
KIDLT1      1   -0.447254      0.098897       -4.522       0.0001  CHILD AGED LESS THAN 1? (1/0)
KID14       1   -0.486508      0.068431       -7.109       0.0001  CHILD AGED 1 TO 4? (1/0)
KID511      1   -0.444468      0.082313       -5.400       0.0001  CHILD AGED 5 TO 11? (1/0)
F1217       1   -0.217789      0.125130       -1.741       0.0820  FEMALE AGED 12 TO 17? (1/0)
M1217       1   -0.744808      0.221134       -3.368       0.0008  MALE AGED 12 TO 17? (1/0)
F1824       1    0.158198      0.078914        2.005       0.0452  FEMALE AGED 18 TO 24? (1/0)
M1824       1    2.491629      0.891908        2.794       0.0053  MALE AGED 18 TO 24? (1/0)
M2544       1   -0.045430      0.242489       -0.187       0.8514  MALE AGED 25 TO 44? (1/0)
F4564       1   -0.513109      0.182650       -2.809       0.0050  FEMALE AGED 45 TO 64? (1/0)
M4564       1   -0.181431      0.629207       -0.288       0.7731  MALE AGED 45 TO 64? (1/0)
DAVIS       1    0.191010      0.082133        2.326       0.0202  DEC. RESIDENT, DAVIS COUNTY? (1/0)
UTAH        1   -0.084957      0.060938       -1.394       0.1635  DEC. RESIDENT, UTAH COUNTY? (1/0)
WEBER       1    0.063742      0.065161        0.978       0.3281  DEC. RESIDENT, WEBER COUNTY? (1/0)
BLACK       1    0.163662      0.149371        1.096       0.2734  BLACK RACE? (1/0)
LATINO      1    0.116938      0.078207        1.495       0.1351  HISPANIC ORIGIN? (1/0)
OTHRAC      1    0.089279      0.171525        0.521       0.6028  OTHER RACIAL/ETHNIC GROUP? (1/0)
```

OLS Spending Equation, for Users

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                                          REG: SPECIALIST USE.

DEP VARIABLE: DOCDL2

                      SUM OF           MEAN
SOURCE       DF      SQUARES         SQUARE       F VALUE       PROB>F

MODEL        18    53.574037       2.976335         2.199       0.0029
ERROR       161      894.599       1.353401
C TOTAL     179      948.173

      ROOT MSE      1.163358     R-SQUARE        0.0565
      DEP MEAN      3.965570     ADJ R-SQ        0.0308
      C.V.          29.33647

                     PARAMETER       STANDARD   T FOR H0:                       VARIABLE
VARIABLE     DF       ESTIMATE          ERROR  PARAMETER=0    PROB > |T|          LABEL

INTERCEP      1       3.650389       0.219048       16.847        0.0001   INTERCEPT
CM1           1  -0.000877827       0.097160       -0.009        0.9928   CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6        1       0.060936       0.030621        1.990        0.0470
KIDLT1        1      -0.085339       0.285913       -0.298        0.7654   CHILD AGED LESS THAN 1? (1/0)
KID14         1      -0.245365       0.136710       -1.795        0.0731   CHILD AGED 1 TO 4? (1/0)
KID511        1      -0.172598       0.167265       -1.032        0.3025   CHILD AGED 5 TO 11? (1/0)
F1217         1       0.170845       0.196224        0.871        0.3843   FEMALE AGED 12 TO 17? (1/0)
M1217         1      -0.324341       0.260564       -1.245        0.2137   MALE AGED 12 TO 17? (1/0)
F1824         1     0.00817733       0.129651        0.063        0.9497   FEMALE AGED 18 TO 24? (1/0)
M1824         1       0.750161       0.593731        1.263        0.2069   MALE AGED 18 TO 24? (1/0)
M2544         1       0.640657       0.251746        2.545        0.0112   MALE AGED 25 TO 44? (1/0)
F4564         1       0.096261       0.305336        0.315        0.7527   FEMALE AGED 45 TO 64? (1/0)
M4564         1       1.188103       0.486888        2.440        0.0149   MALE AGED 45 TO 64? (1/0)
DAVIS         1       0.174446       0.169265        1.031        0.3031   DEC. RESIDENT. DAVIS COUNTY? (1/0)
UTAH          1      -0.089818       0.128045       -0.701        0.4833   DEC. RESIDENT. UTAH COUNTY? (1/0)
WEBER         1      -0.128538       0.112780       -1.140        0.2548   DEC. RESIDENT. WEBER COUNTY? (1/0)
BLACK         1       0.102546       0.282737        0.363        0.7170   BLACK RACE? (1/0)
LATINO        1      -0.376067       0.152612       -2.464        0.0140   HISPANIC ORIGIN? (1/0)
OTHRAC        1  -.0000867543       0.277221       -0.000        0.9998   OTHER RACIAL/ETHNIC GROUP? (1/0)
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OLS Spending Equation, for Users

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                                                            REG: OUTPATIENT DEPT. USE

DEP VARIABLE: OPDOL

                         SUM OF           MEAN
SOURCE       DF         SQUARES         SQUARE        F VALUE        PROB>F

MODEL        18       52.196986       2.899833          2.696        0.0002
ERROR       620         666.940       1.075710
C TOTAL     638         719.137

    ROOT MSE           1.037165       R-SQUARE         0.0726
    DEP MEAN           3.875226       ADJ R-SQ         0.0457
    C.V.               26.76398

                      PARAMETER       STANDARD    T FOR HO:                      VARIABLE
VARIABLE     DF        ESTIMATE          ERROR  PARAMETER=0    PROB > |T|          LABEL

INTERCEP      1        3.585284       0.215617       16.628        0.0001  INTERCEPT
CMI           1       -0.293978       0.089975       -3.267        0.0011  CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6        1        0.083462       0.030488        2.738        0.0064
KIDLT1        1       -0.157438       0.207811       -0.758        0.4490  CHILD AGED LESS THAN 1? (1/0)
KID14         1       -0.130775       0.123914       -1.055        0.2917  CHILD AGED 1 TO 4? (1/0)
KID511        1     -0.00988058       0.161383       -0.061        0.9512  CHILD AGED 5 TO 11? (1/0)
F1217         1       -0.213987       0.181511       -1.179        0.2389  FEMALE AGED 12 TO 17? (1/0)
M1217         1        0.471163       0.355843        1.324        0.1860  MALE AGED 12 TO 17? (1/0)
F1824         1        0.085733       0.115103        0.745        0.4567  FEMALE AGED 18 TO 24? (1/0)
M1824         1       -0.133066       0.615271       -0.216        0.8288  MALE AGED 18 TO 24? (1/0)
M2544         1        0.549882       0.300652        1.829        0.0679  MALE AGED 25 TO 44? (1/0)
F4564         1       -0.048550       0.283155       -0.171        0.8639  FEMALE AGED 45 TO 64? (1/0)
M4564         1        0.834235       0.359070        2.323        0.0205  MALE AGED 45 TO 64? (1/0)
DAVIS         1        0.109271       0.163386        0.669        0.5039  DEC. RESIDENT. DAVIS COUNTY? (1/0)
UTAH          1       -0.228862       0.114972       -1.991        0.0470  DEC. RESIDENT. UTAH COUNTY? (1/0)
WEBER         1        0.179337       0.111065        1.615        0.1069  DEC. RESIDENT. WEBER COUNTY? (1/0)
BLACK         1       -0.052100       0.247754       -0.210        0.8335  BLACK RACE? (1/0)
LATINO        1     -0.00565492       0.127154       -0.044        0.9645  HISPANIC ORIGIN? (1/0)
OTHRAC        1        0.178338       0.263861        0.676        0.4994  OTHER RACIAL/ETHNIC GROUP? (1/0)
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OLS Spending Equation, for Users'

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                                                       REG: DRUG USE

DEP VARIABLE: TOTDRG
                         SUM OF          MEAN
SOURCE       DF         SQUARES        SQUARE       F VALUE       PROB>F

MODEL        18         366.617     20.367630        35.664       0.0001
ERROR      3114        1778.409      0.571101
C TOTAL    3132        2145.027

      ROOT MSE         0.755712      R-SQUARE        0.1709
      DEP MEAN         2.509303      ADJ R-SQ        0.1661
      C.V.             30.11642

                      PARAMETER      STANDARD    T FOR H0:                      VARIABLE
VARIABLE     DF        ESTIMATE         ERROR  PARAMETER=0    PROB > |T|         LABEL

INTERCEP      1        1.891674      0.070620       26.787        0.0001  INTERCEPT
CMI           1  0.004041005         0.029762        0.136        0.8920  CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6        1        0.135978      0.010312       13.186        0.0001
KIDLT1        1       -0.245036      0.073076       -3.353        0.0008  CHILD AGED LESS THAN 1? (1/0)
KID14         1       -0.360769      0.040561       -8.894        0.0001  CHILD AGED 1 TO 4? (1/0)
KID511        1       -0.432355      0.046506       -9.297        0.0001  CHILD AGED 5 TO 11? (1/0)
F1217         1       -0.305581      0.069061       -4.425        0.0001  FEMALE AGED 12 TO 17? (1/0)
M1217         1       -0.222787      0.109849       -2.028        0.0426  MALE AGED 12 TO 17? (1/0)
F1824         1       -0.135876      0.037723       -3.602        0.0003  FEMALE AGED 18 TO 24? (1/0)
M1824         1        0.494563      0.437585        1.130        0.2585  MALE AGED 18 TO 24? (1/0)
M2544         1        0.484199      0.113087        4.282        0.0001  MALE AGED 25 TO 44? (1/0)
F4564         1        0.604261      0.083831        7.208        0.0001  FEMALE AGED 45 TO 64? (1/0)
M4564         1        0.608853      0.144962        4.200        0.0001  MALE AGED 45 TO 64? (1/0)
DAVIS         1        0.148581      0.048827        3.043        0.0024  DEC. RESIDENT. DAVIS COUNTY? (1/0)
UTAH          1        0.030768      0.036361        0.846        0.3975  DEC. RESIDENT. UTAH COUNTY? (1/0)
WEBER         1        0.066267      0.034879        1.900        0.0575  DEC. RESIDENT. WEBER COUNTY? (1/0)
BLACK         1  0.001634853         0.084282        0.019        0.9845  BLACK RACE? (1/0)
LATINO        1       -0.106796      0.043839       -2.436        0.0149  HISPANIC ORIGIN? (1/0)
OTHRAC        1       -0.063781      0.099027       -0.644        0.5196  OTHER RACIAL/ETHNIC GROUP? (1/0)
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OLS Spending Equation, for Users

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                                                                  REG: CLINIC DOCTOR USE

DEP VARIABLE: CLNDL1

                       SUM OF          MEAN
SOURCE        DF      SQUARES        SQUARE        F VALUE        PROB>F

MODEL         18    23.455523      1.303085          1.536        0.0736
ERROR        433      367.287      0.848237
C TOTAL      451      390.742

     ROOT MSE        0.920598      R-SQUARE         0.0600
     DEP MEAN        3.182497      ADJ R-SQ         0.0210
     C.V.            28.93548

                    PARAMETER      STANDARD     T FOR H0:                       VARIABLE
VARIABLE      DF     ESTIMATE         ERROR   PARAMETER=0    PROB > |T|          LABEL

INTERCEP       1     3.096678      0.243859        12.699        0.0001   INTERCEPT
CMI            1     0.126173      0.100364         1.257        0.2094   CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6         1     0.031945      0.034153         0.935        0.3501
KIDLT1         1    -0.171601      0.193768        -0.886        0.3763   CHILD AGED LESS THAN 1? (1/0)
KID14          1    -0.429171      0.129497        -3.314        0.0010   CHILD AGED 1 TO 4? (1/0)
KID511         1    -0.372556      0.171650        -2.170        0.0305   CHILD AGED 5 TO 11? (1/0)
F1217          1    -0.140283      0.189052        -0.742        0.4586   FEMALE AGED 12 TO 17? (1/0)
M1217          1    -0.196866      0.427002        -0.461        0.6450   MALE AGED 12 TO 17? (1/0)
F1824          1    -0.111217      0.130798        -0.850        0.3956   FEMALE AGED 18 TO 24? (1/0)
M1824          1    -0.891919      0.932922        -0.956        0.3396   MALE AGED 18 TO 24? (1/0)
M2544          1    -0.333113      0.473147        -0.704        0.4818   MALE AGED 25 TO 44? (1/0)
F4564          1     0.051788      0.267259         0.194        0.8464   FEMALE AGED 45 TO 64? (1/0)
M4564          1     0.424708      0.438746         0.968        0.3336   MALE AGED 45 TO 64? (1/0)
DAVIS          1     0.020636      0.181008         0.114        0.9093   DEC. RESIDENT. DAVIS COUNTY? (1/0)
UTAH           1     0.047660      0.242846         0.196        0.8445   DEC. RESIDENT. UTAH COUNTY? (1/0)
WEBER          1     0.092314      0.110265         0.837        0.4029   DEC. RESIDENT. WEBER COUNTY? (1/0)
BLACK          1     0.018569      0.217976         0.085        0.9322   BLACK RACE? (1/0)
LATINO         1    -0.186876      0.147717        -1.265        0.2065   HISPANIC ORIGIN? (1/0)
OTHRAC         1     0.018928      0.339698         0.056        0.9556   OTHER RACIAL/ETHNIC GROUP? (1/0)
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OLS Spending Equation, for Users

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                                                                REG: HOSP. PHYSICIAN USE

DEP VARIABLE: HOSDLI

                     SUM OF          MEAN
SOURCE       DF     SQUARES        SQUARE      F VALUE      PROB>F

MODEL        17   25.538460      1.502262        2.750      0.0003
ERROR       335     182.974      0.546192
C TOTAL     352     208.513

    ROOT MSE       0.739048      R-SQUARE       0.1225
    DEP MEAN       3.306545      ADJ R-SQ       0.0779
    C.V.           22.35783

                  PARAMETER      STANDARD   T FOR H0:                        VARIABLE
VARIABLE     DF    ESTIMATE         ERROR   PARAMETER=0   PROB > |T|           LABEL

INTERCEP      1    3.237108      0.217275       14.899      0.0001   INTERCEPT
CMI           1   -0.096491      0.087431       -1.104      0.2705   CASE MANAGED BEFORE 12/1/83? (1/0)
PRUSE6        1    0.012128      0.030692        0.395      0.6930
KIDLT1        1   -0.141070      0.187715       -0.752      0.4529   CHILD AGED LESS THAN 1? (1/0)
KID14         1   -0.176882      0.119672       -1.478      0.1403   CHILD AGED 1 TO 4? (1/0)
KID511        1   -0.167751      0.174506       -0.961      0.3371   CHILD AGED 5 TO 11? (1/0)
F1217         1   -0.293292      0.181777       -1.613      0.1076   FEMALE AGED 12 TO 17? (1/0)
M1217         1    0.398280      0.313688        1.270      0.2051   MALE AGED 12 TO 17? (1/0)
F1824         1 -0.00278731      0.109318       -0.025      0.9797   FEMALE AGED 18 TO 24? (1/0)
M2544         1    0.301324      0.273946        1.100      0.2721   MALE AGED 25 TO 44? (1/0)
F4564         1    0.043009      0.317092        0.136      0.8922   FEMALE AGED 45 TO 64? (1/0)
M4564         1    0.268576      0.343101        0.783      0.4343   MALE AGED 45 TO 64? (1/0)
DAVIS         1    0.552691      0.175837        3.143      0.0018   DEC. RESIDENT. DAVIS COUNTY? (1/0)
UTAH          1    0.462285      0.108457        4.262      0.0001   DEC. RESIDENT. UTAH COUNTY? (1/0)
WEBER         1   -0.346201      0.339156       -1.021      0.3081   DEC. RESIDENT. WEBER COUNTY? (1/0)
BLACK         1   -0.250653      0.240277       -1.043      0.2976   BLACK RACE? (1/0)
LATINO        1    0.087186      0.119598        0.729      0.4665   HISPANIC ORIGIN? (1/0)
OTHRAC        1    0.556586      0.268985        2.069      0.0393   OTHER RACIAL/ETHNIC GROUP? (1/0)
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